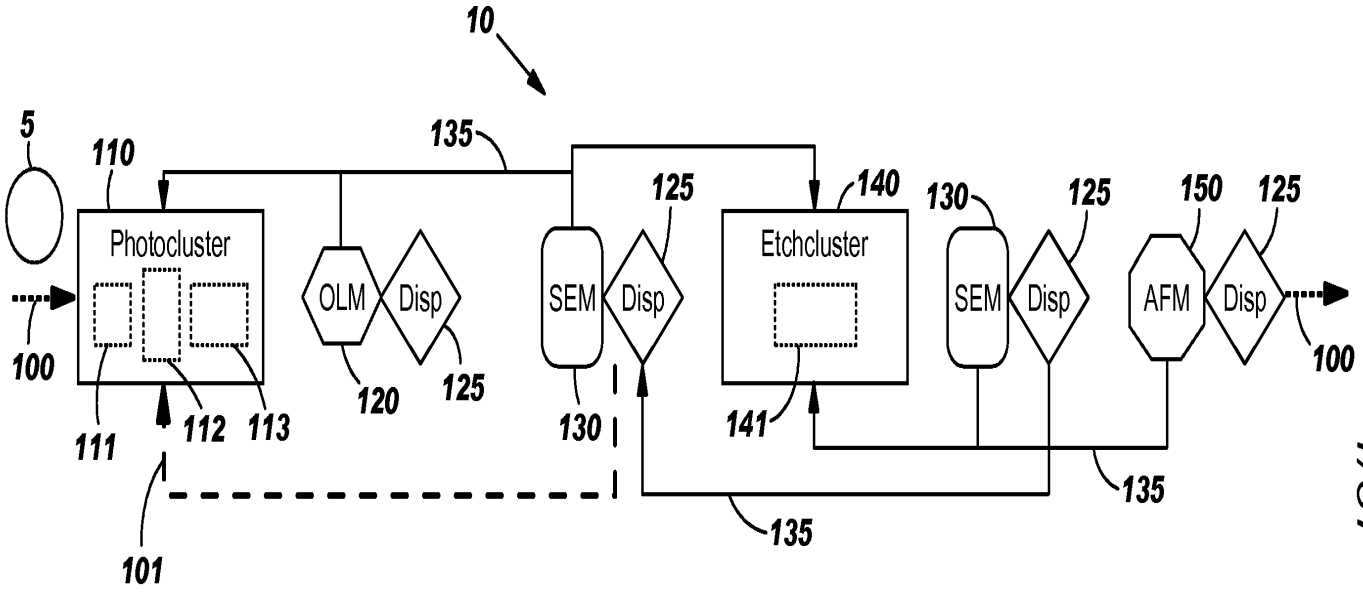
FIG. 1
Prior Art



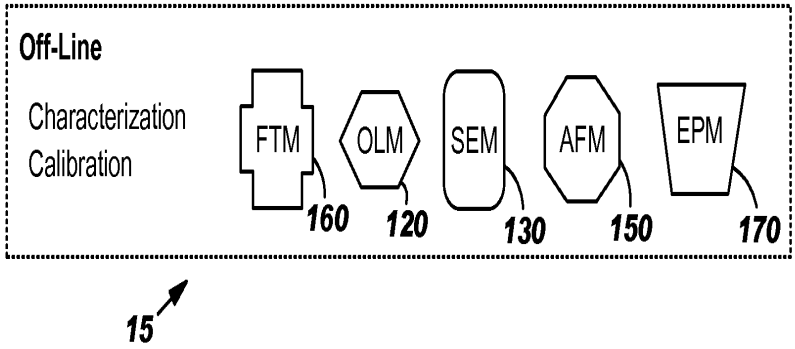


FIG. 2

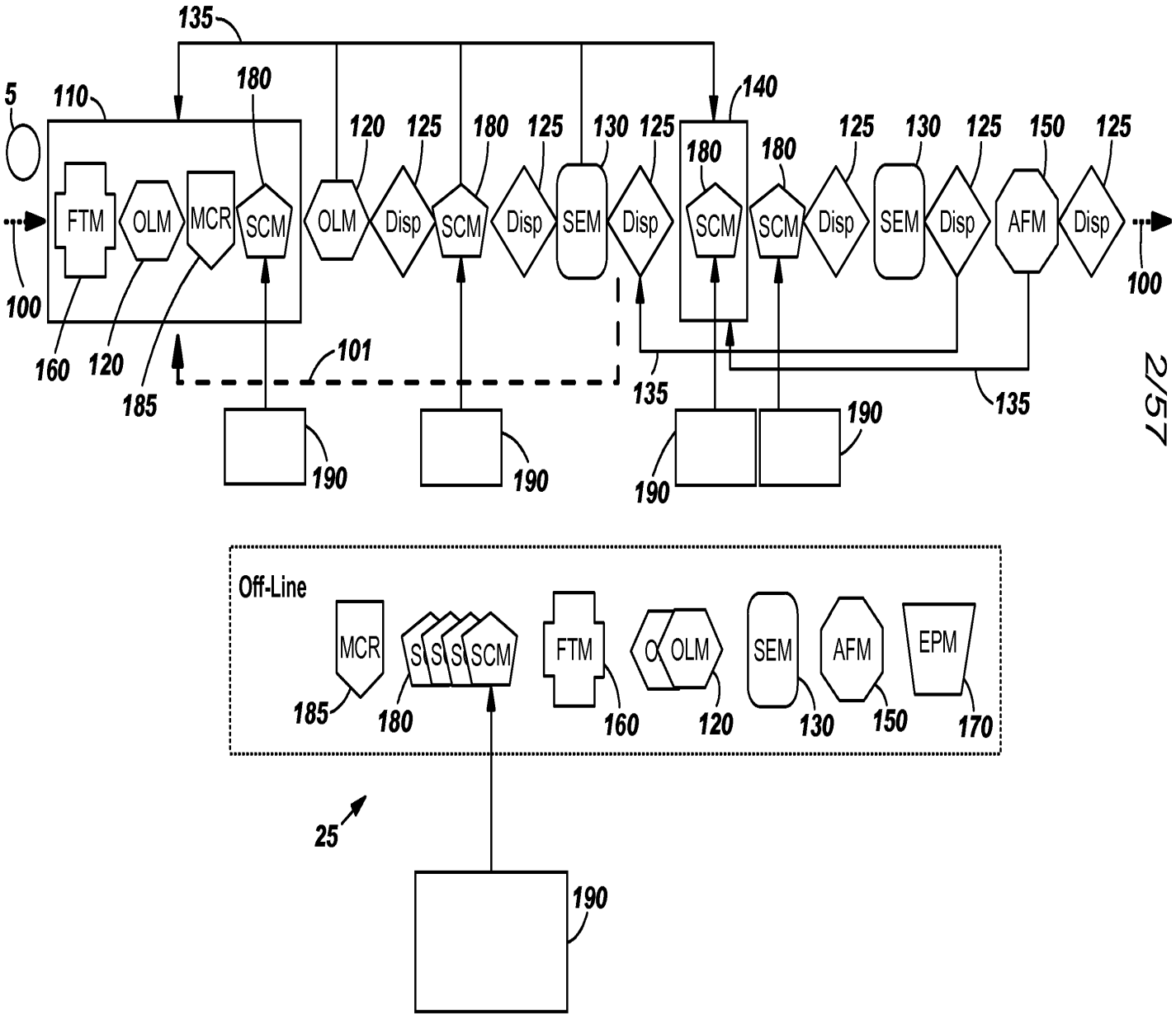


FIG. 3

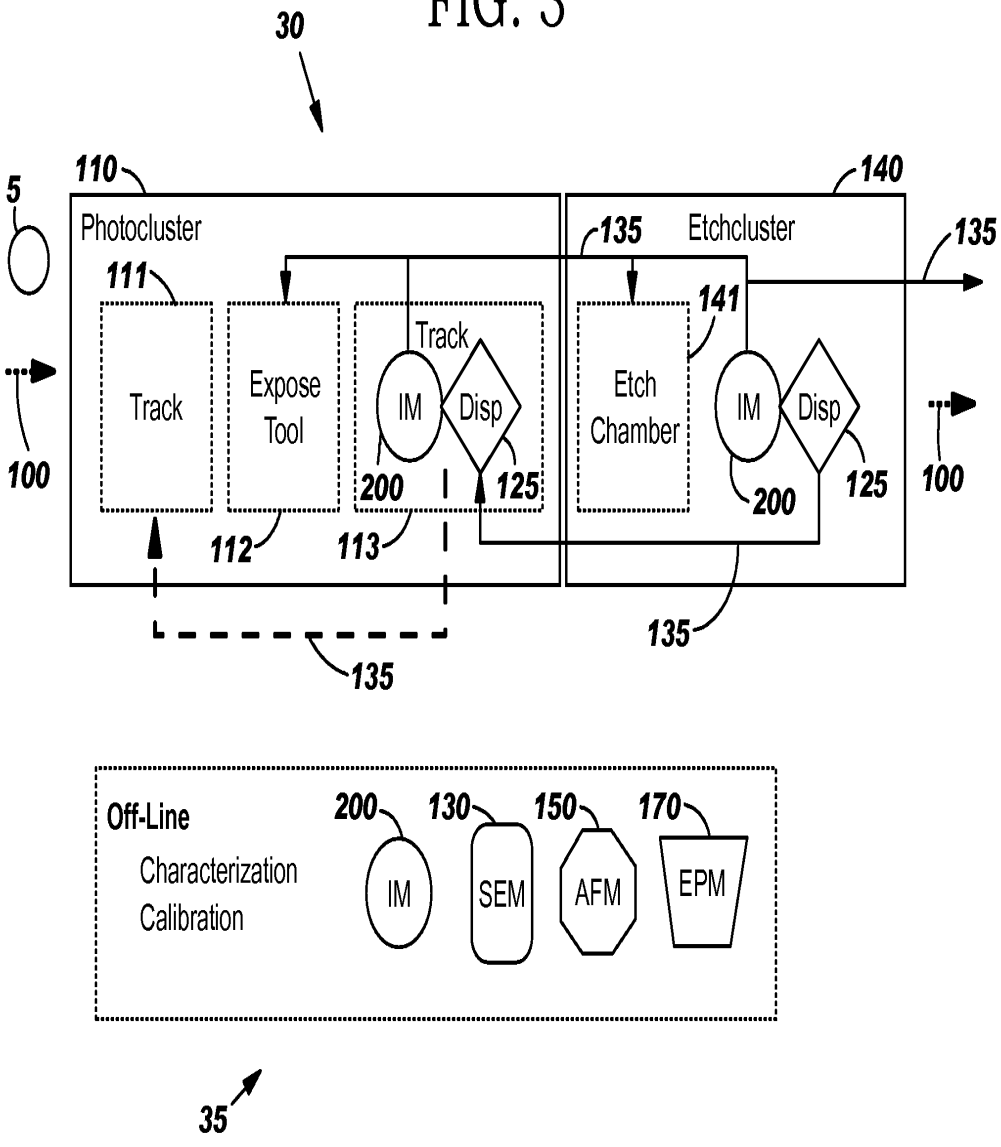

30
110
140
5
Photocluster
135
Etchcluster
135
111
141
Track
Track
Expose Tool
IM
Disp
Etch Chamber
IM
Disp
100
100
200
125
200
125
112
113
135
135
Off-Line
Characterization
Calibration
200
130
150
170
IM
SEM
AFM
EPM
35

FIG. 4A

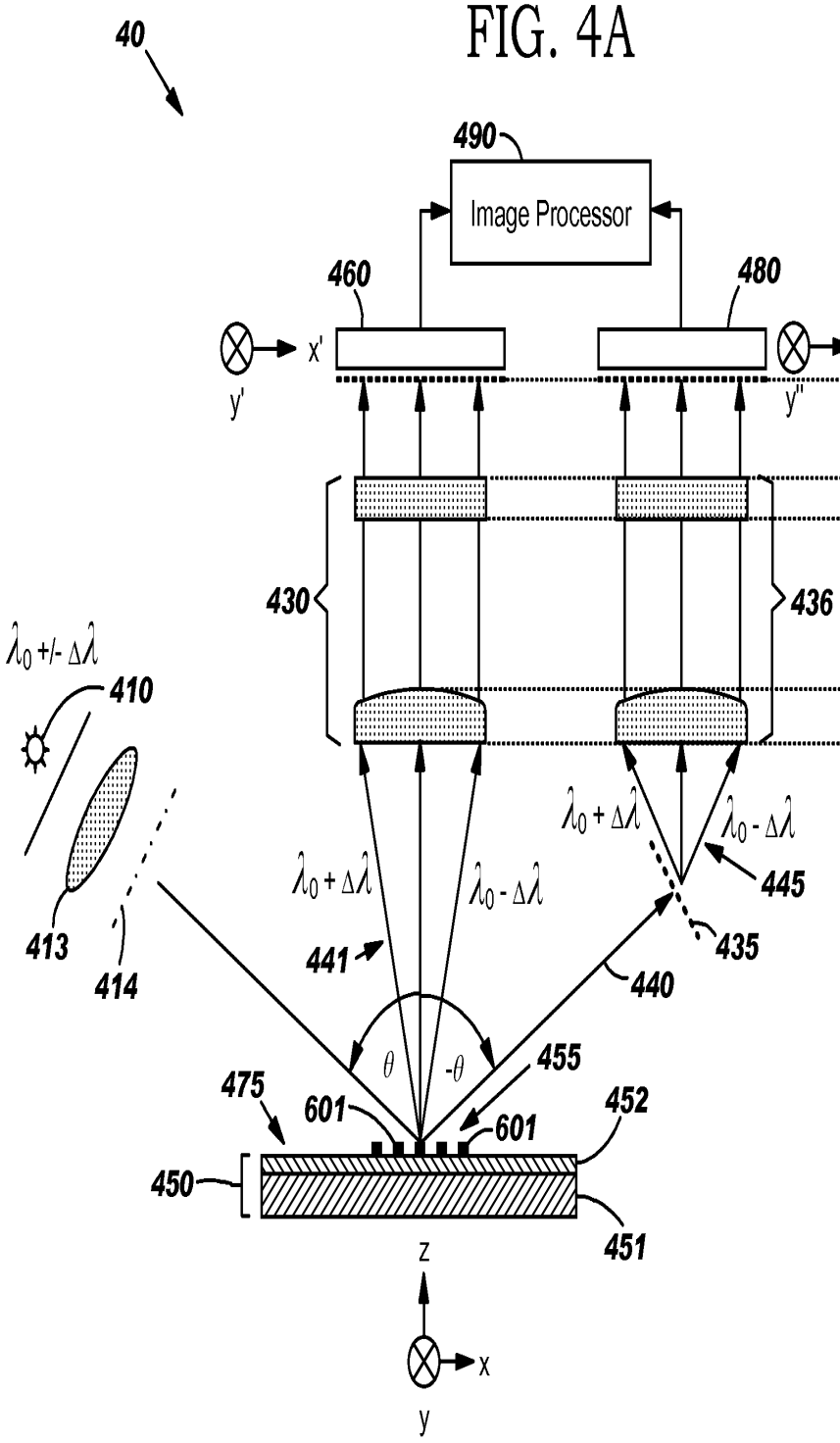

40
490
Image Processor
460
480
x'
x"
y'
y"
430
436
λ_0 +/- $\Delta\lambda$
410
413
414
$\lambda_0 + \Delta\lambda$
$\lambda_0 - \Delta\lambda$
441
445
435
440
θ
-θ
455
475
601
601
452
450
451
z
x
y

FIG. 4B

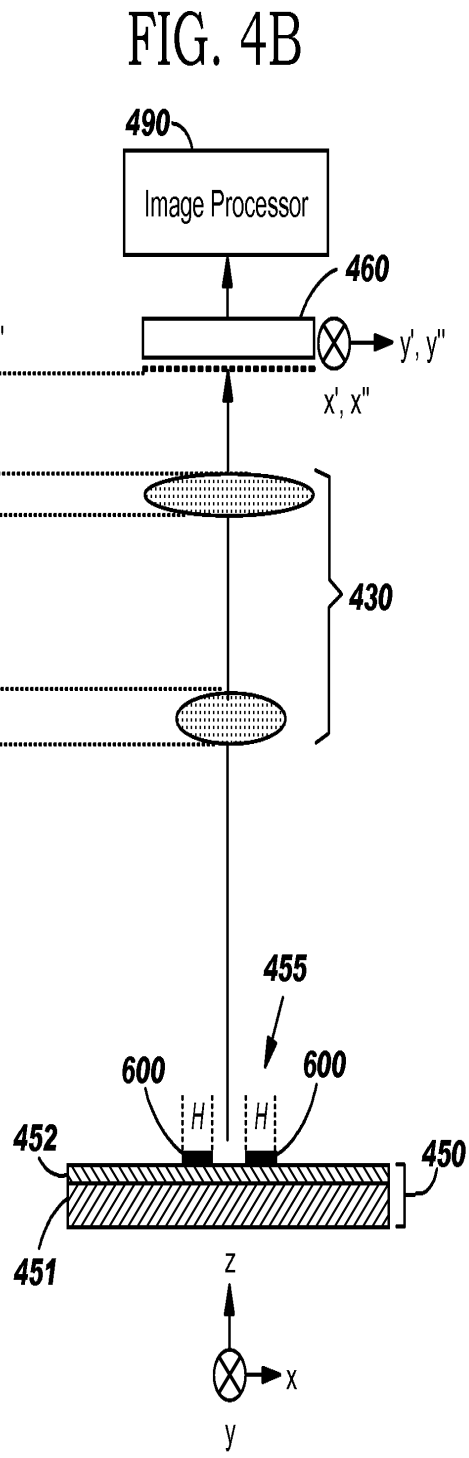

490
Image Processor
460
y', y"
x', x"
430
455
600
600
H
H
452
450
451
z
x
y

FIG. 4C

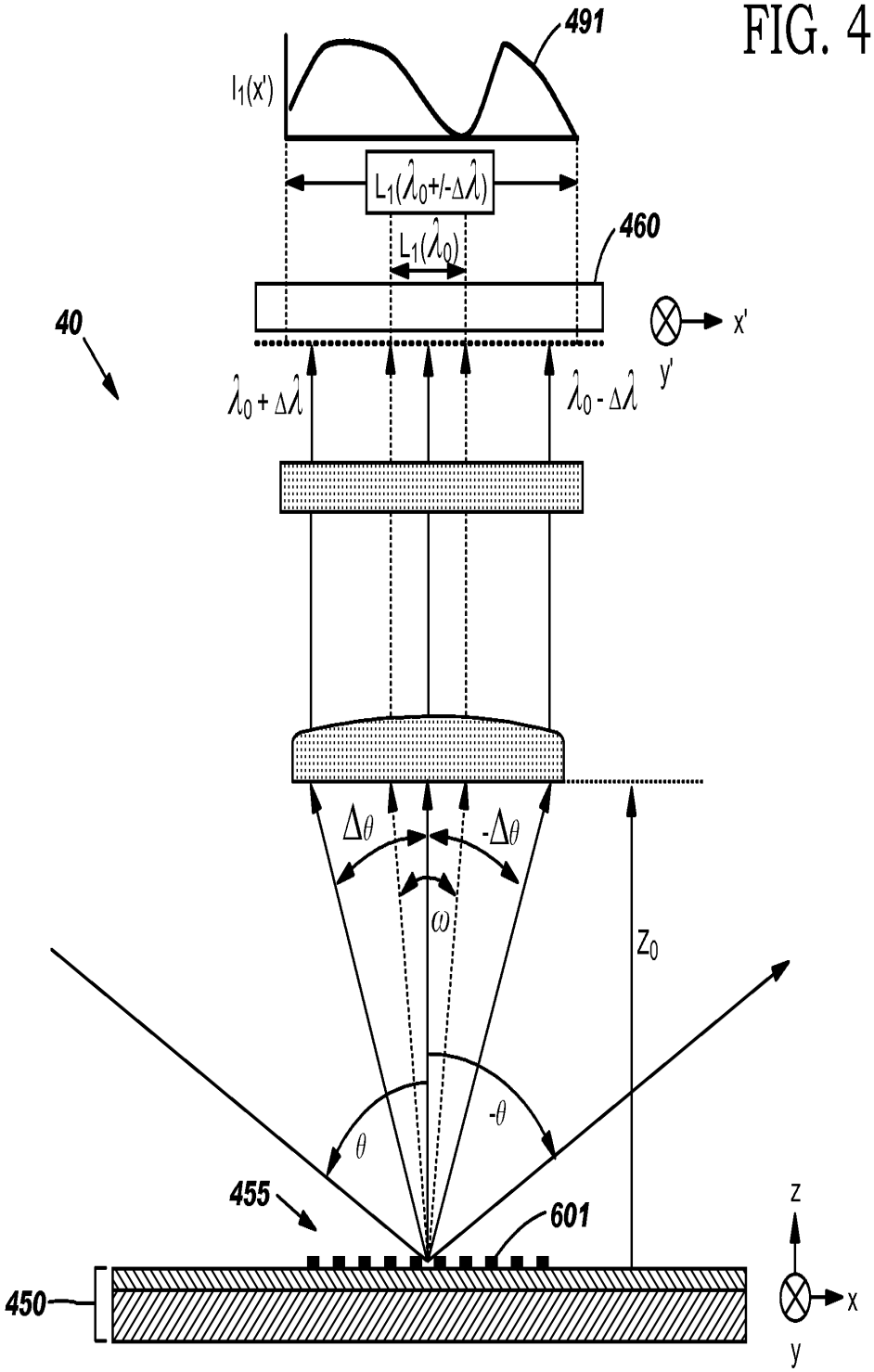

491
$I_1(x')$
$L_1(\lambda_0+/-\Delta\lambda)$
$L_1(\lambda_0)$
460
40
x'
y'
$\lambda_0+\Delta\lambda$
$\lambda_0-\Delta\lambda$
$\Delta\theta$
$-\Delta\theta$
ω
Z_0
θ
$-\theta$
455
601
450
z
x
y

FIG. 4D

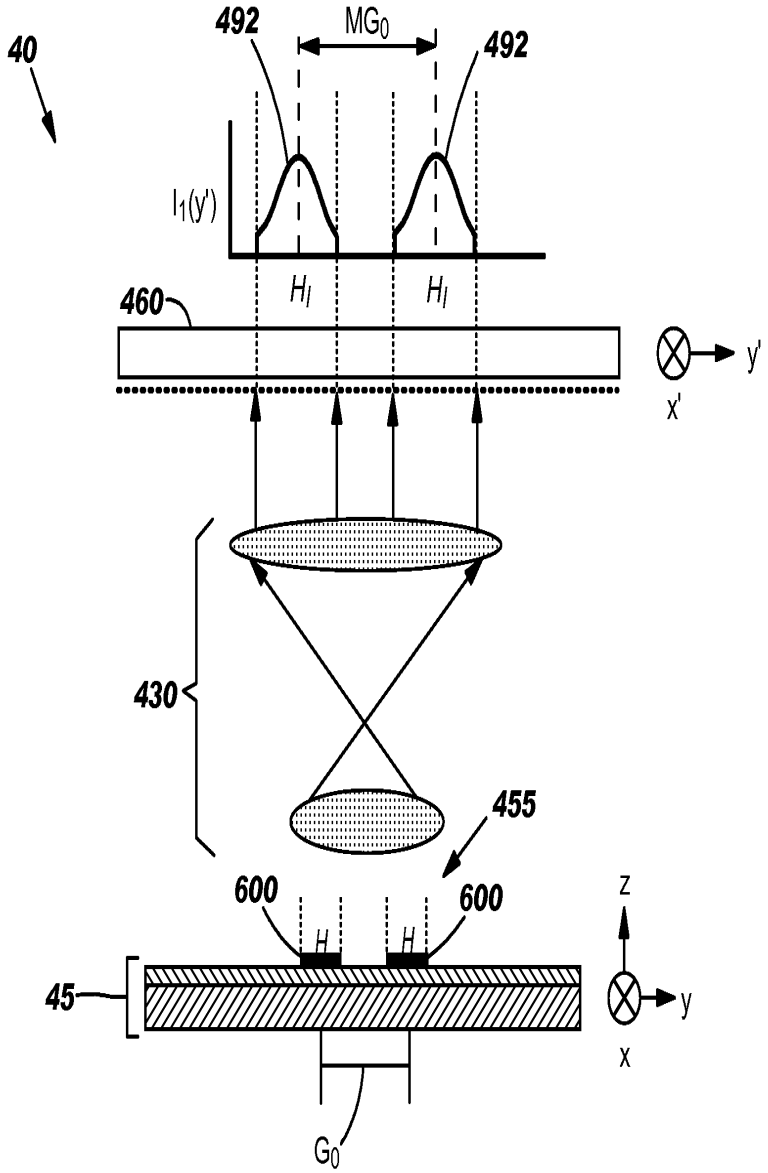


FIG. 5A

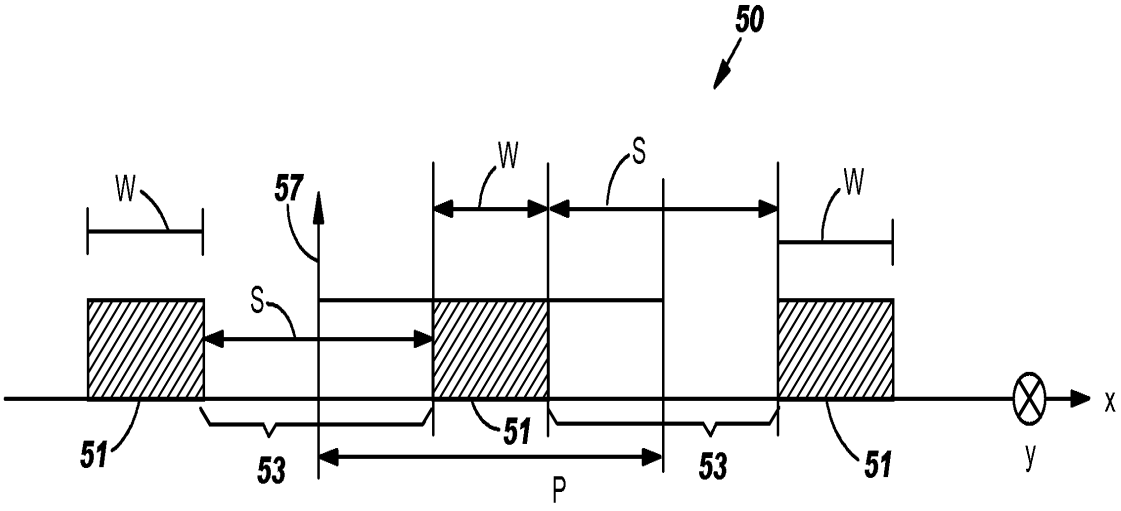

50
W
57
W
S
W
S
x
y
51
53
51
53
51
P

FIG. 5B

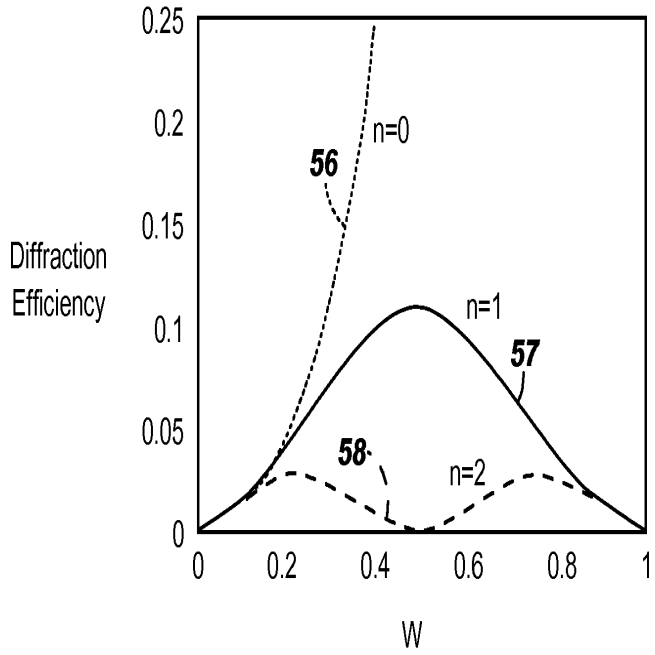

0.25
0.2
0.15
0.1
0.05
0
Diffraction Efficiency
n=0
56
n=1
57
58
n=2
0
0.2
0.4
0.6
0.8
1
W

FIG. 6

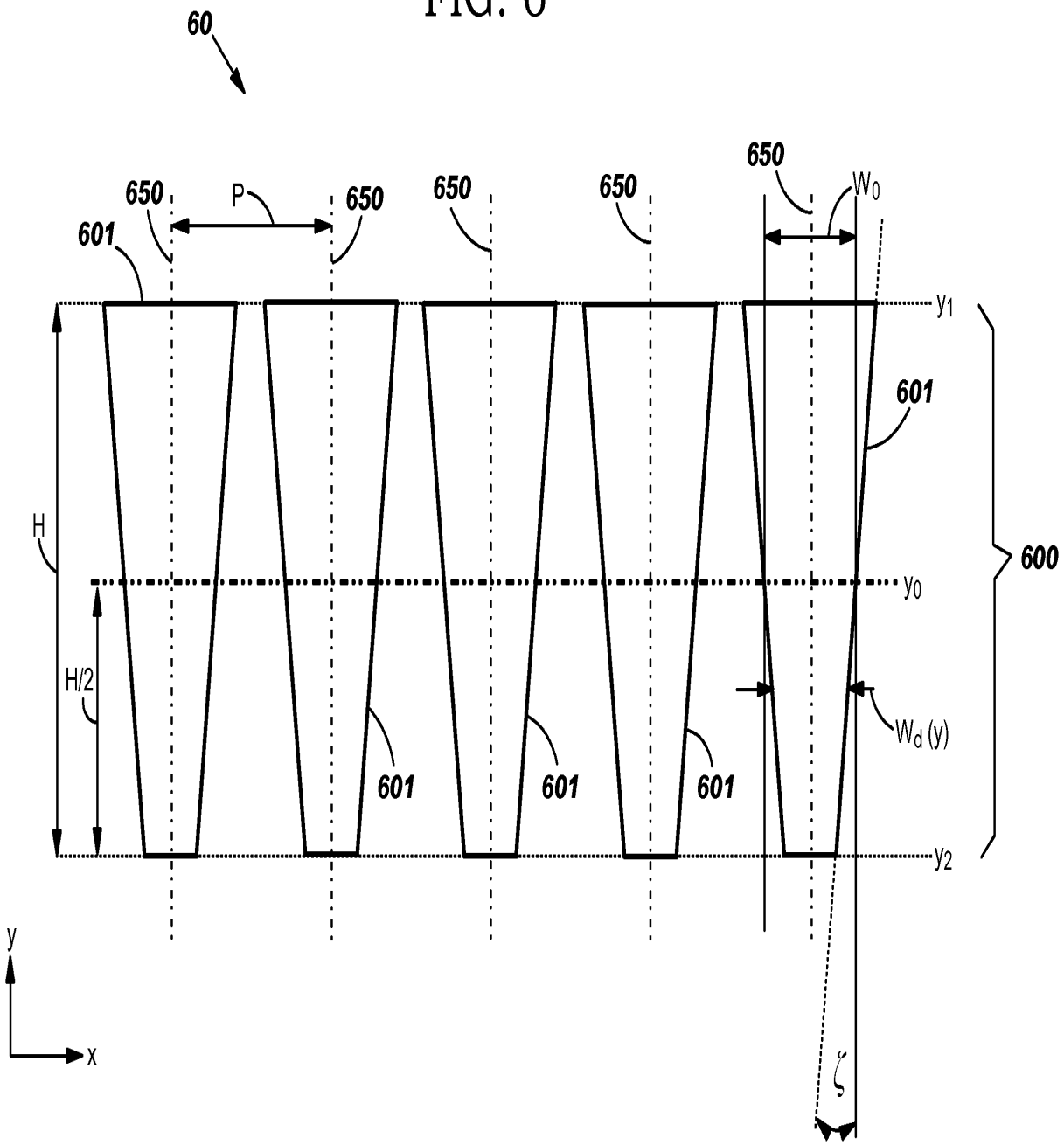

60
650
650
650
650
650
P
W_0
601
601
601
601
601
y_1
y_0
y_2
H
H/2
600
$W_d(y)$
y
x
ζ

FIG. 7A

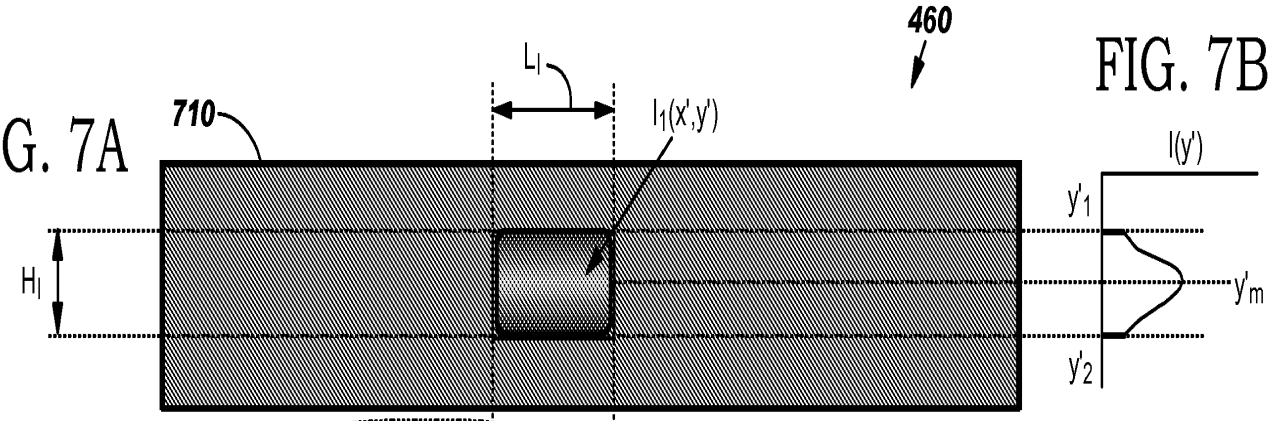


FIG. 7B

FIG. 7C

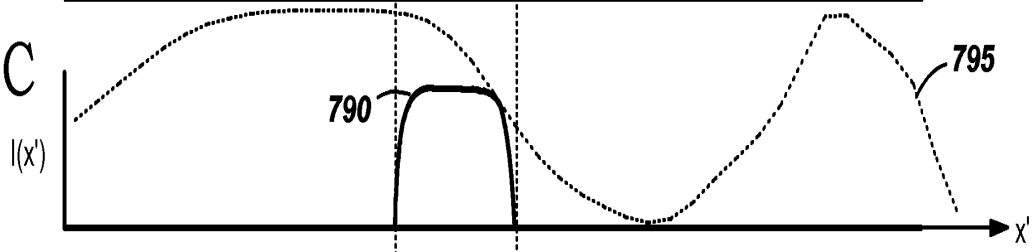


FIG. 7D

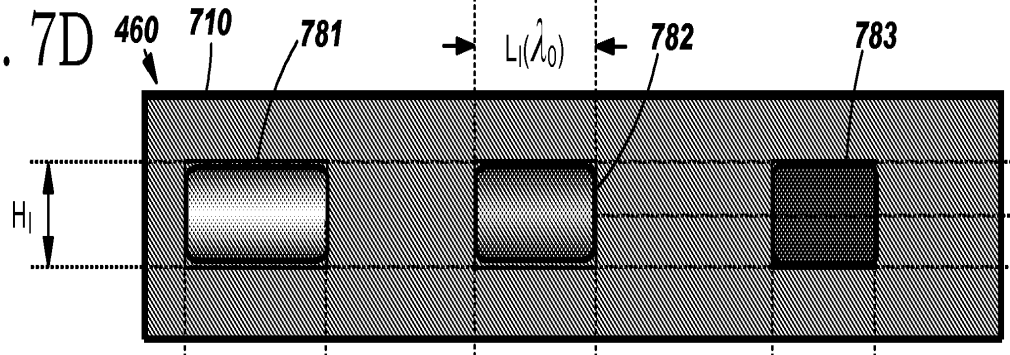


FIG. 7E

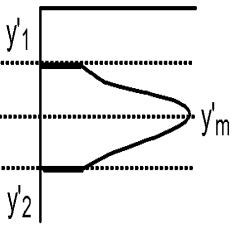


FIG. 7F

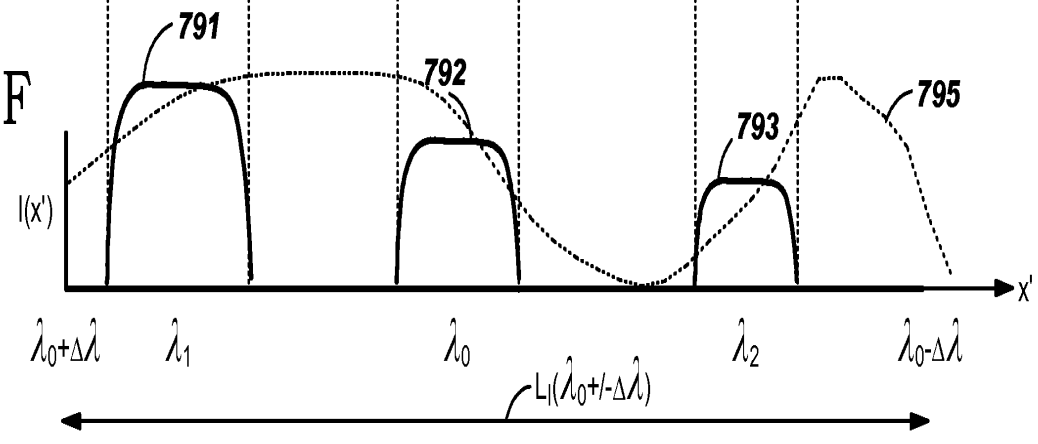


FIG. 8

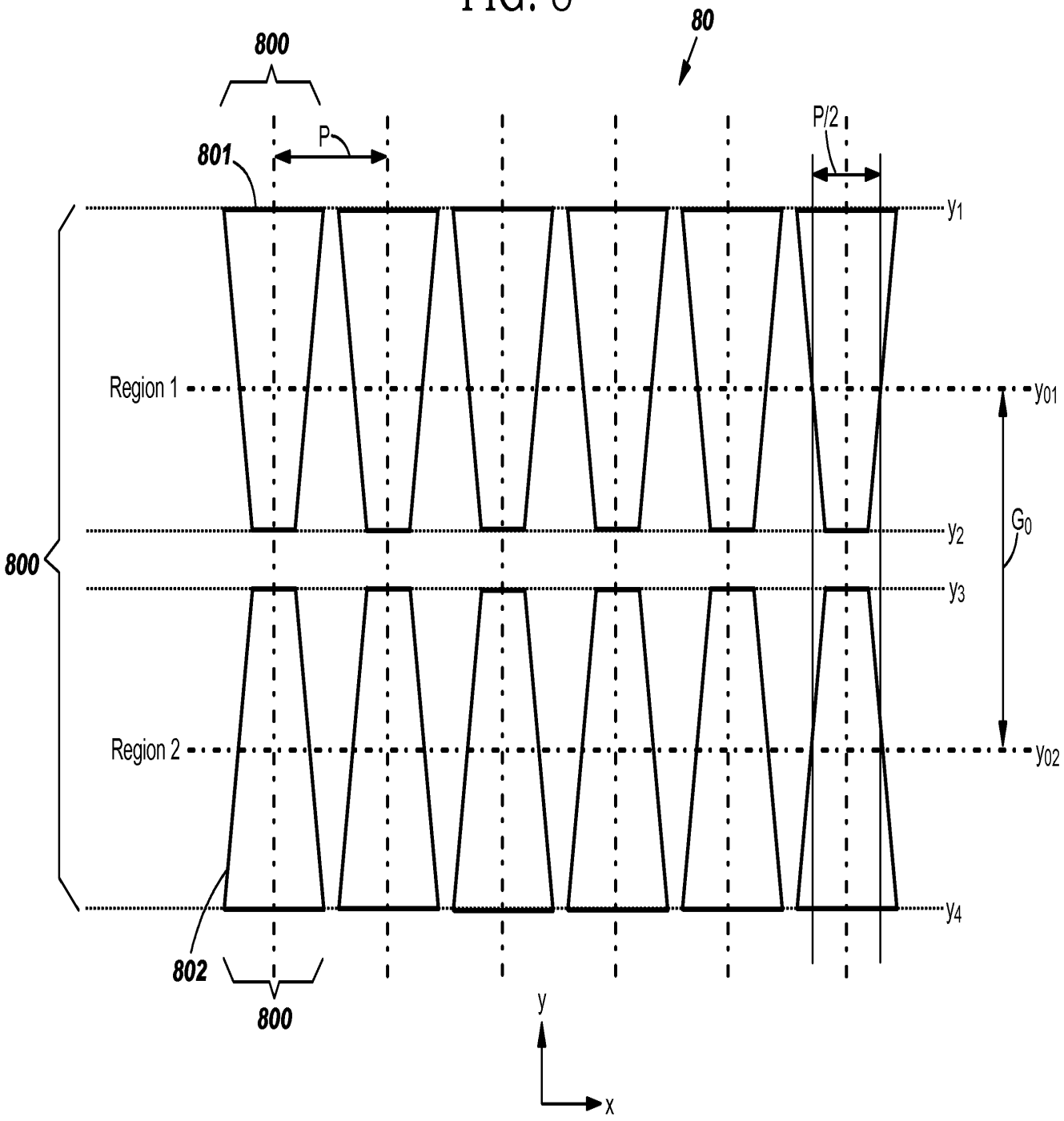

80
800
801
P
P/2
y1
Region 1
y01
y2
G0
y3
Region 2
y02
y4
800
802
800
y
x

FIG. 9A

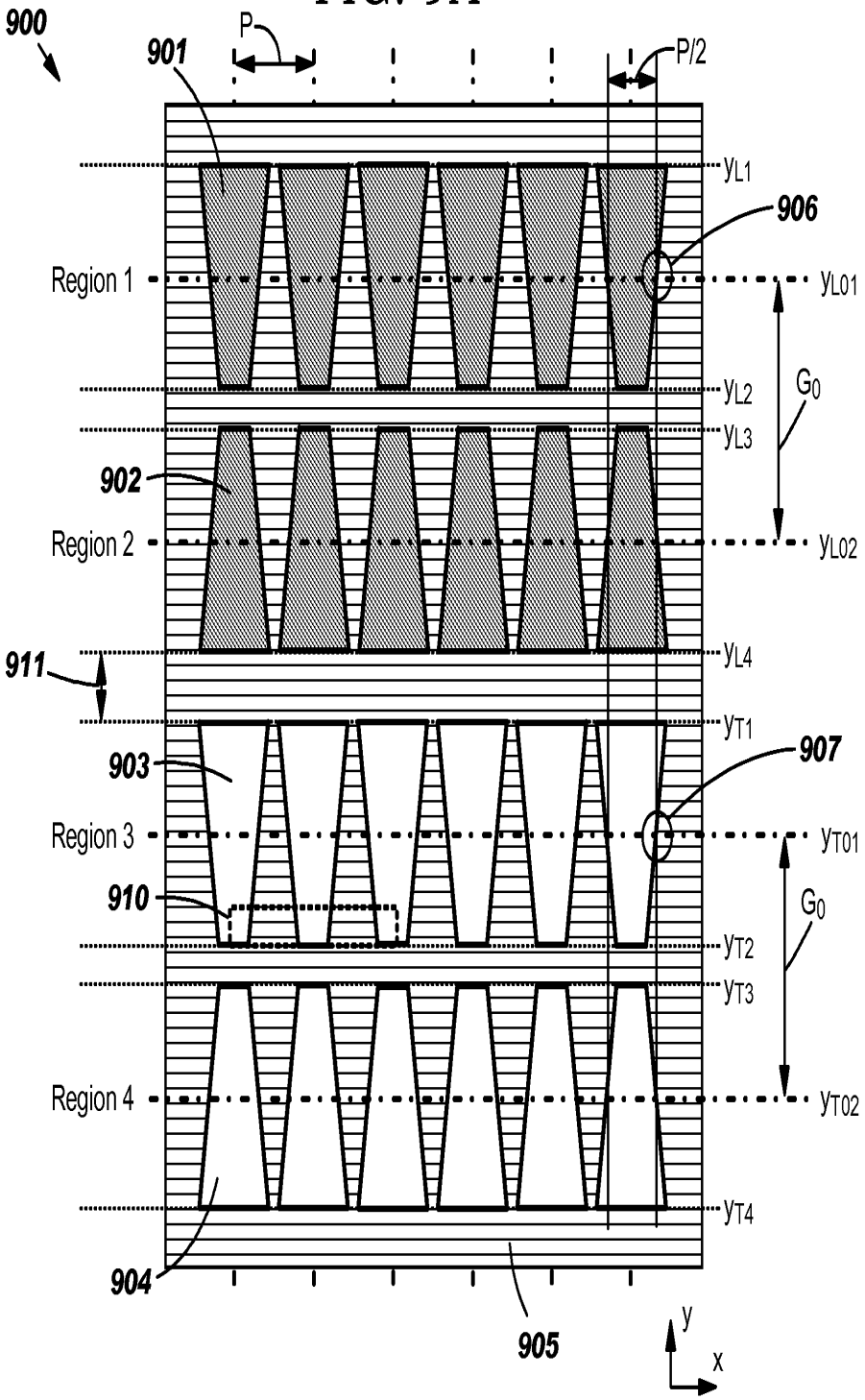


FIG. 9B

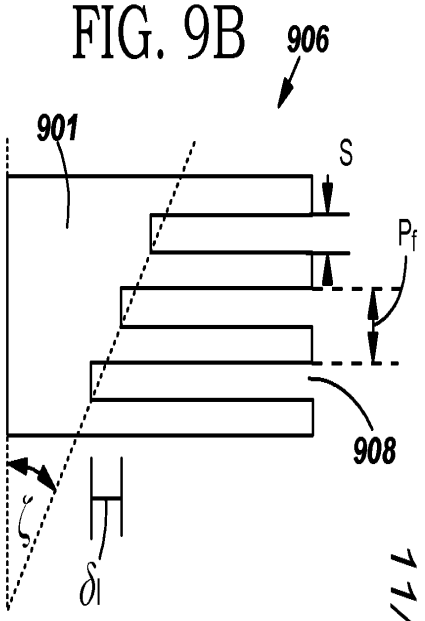
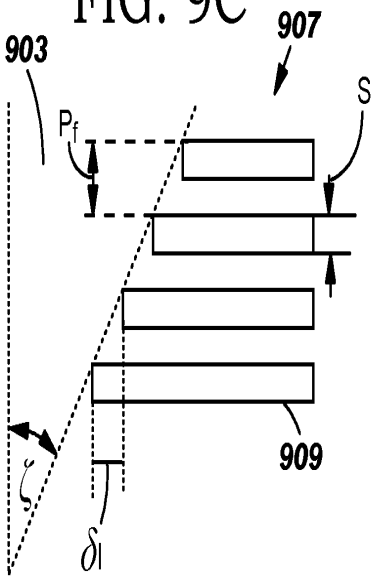


FIG. 9C



FIS920020101US1
Ausschnit

FIG. 10A

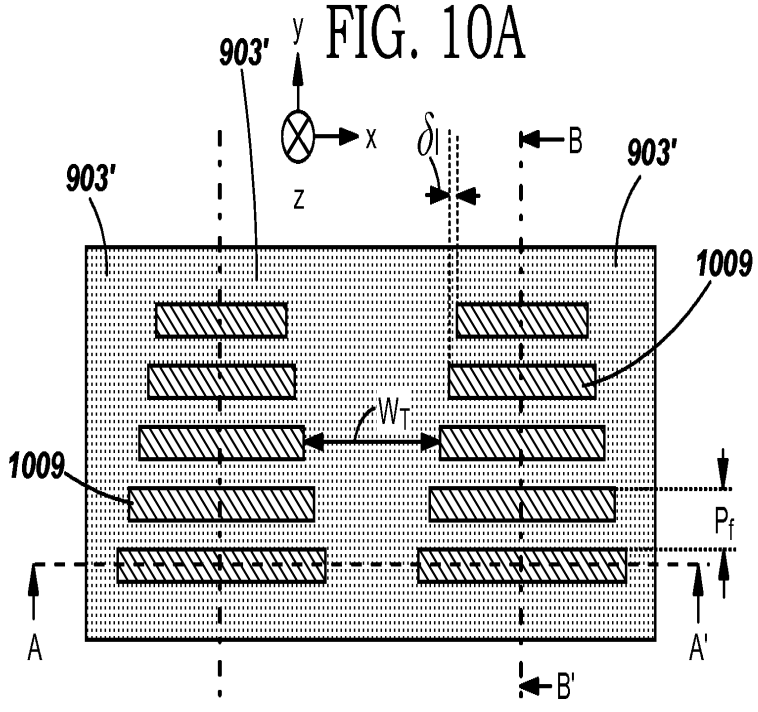


FIG. 10B

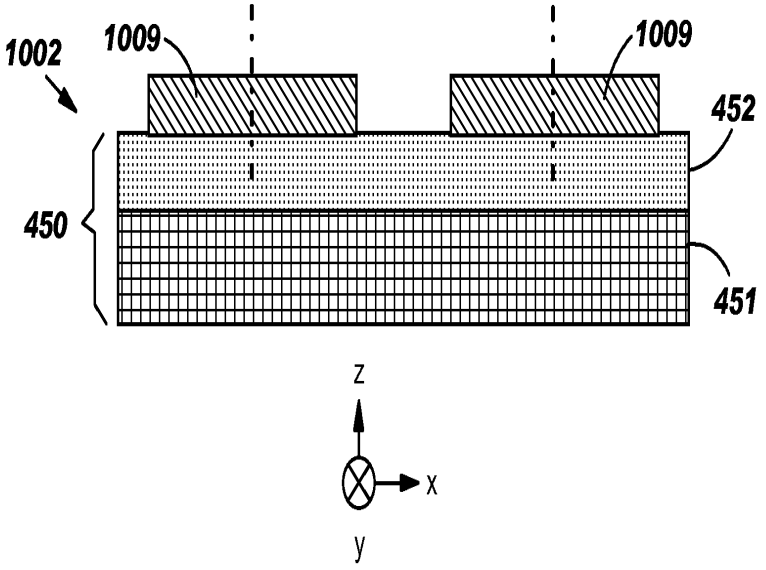


FIG. 10C

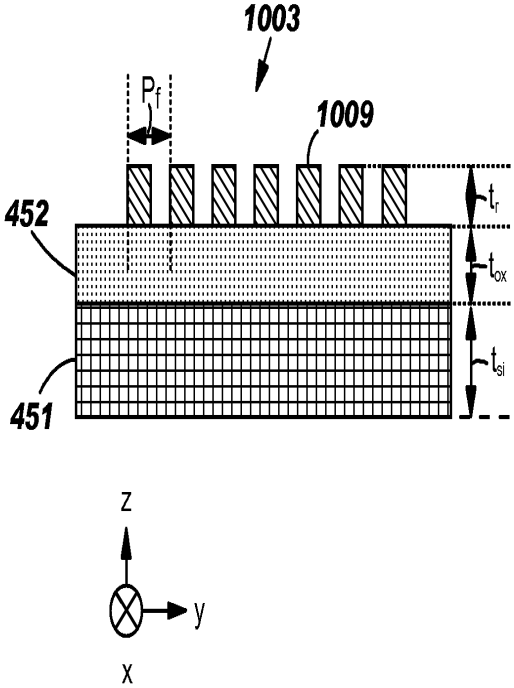


FIG. 11A

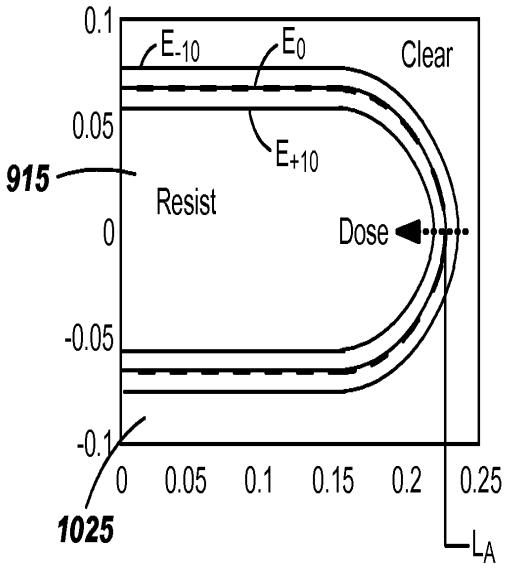


FIG. 11B

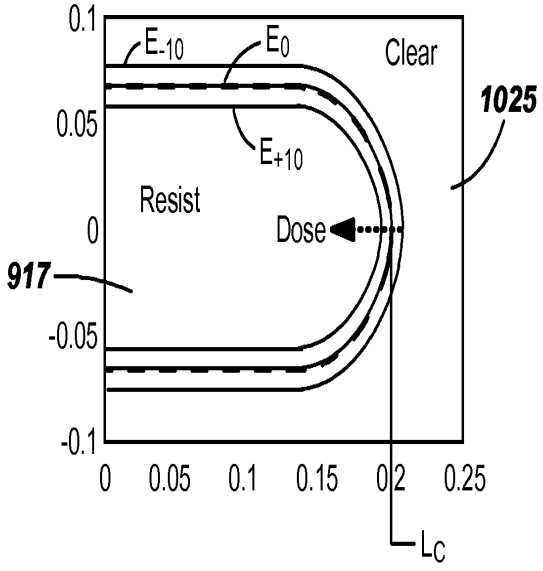


FIG. 11C

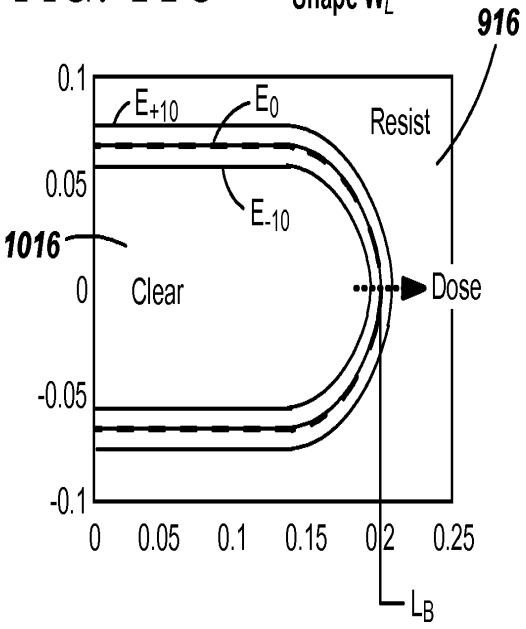


FIG. 11D

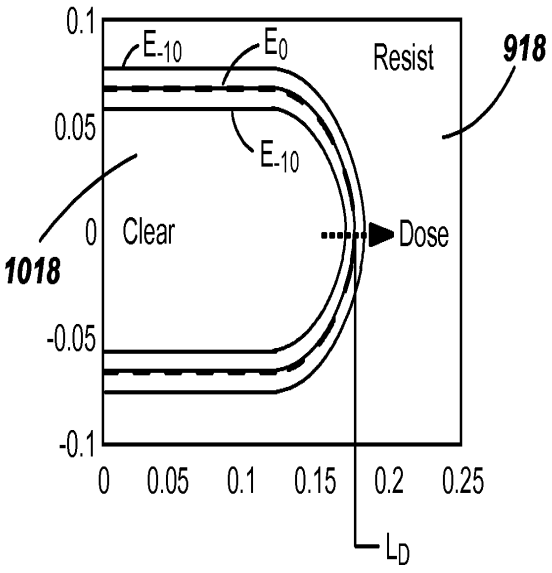


FIG. 12

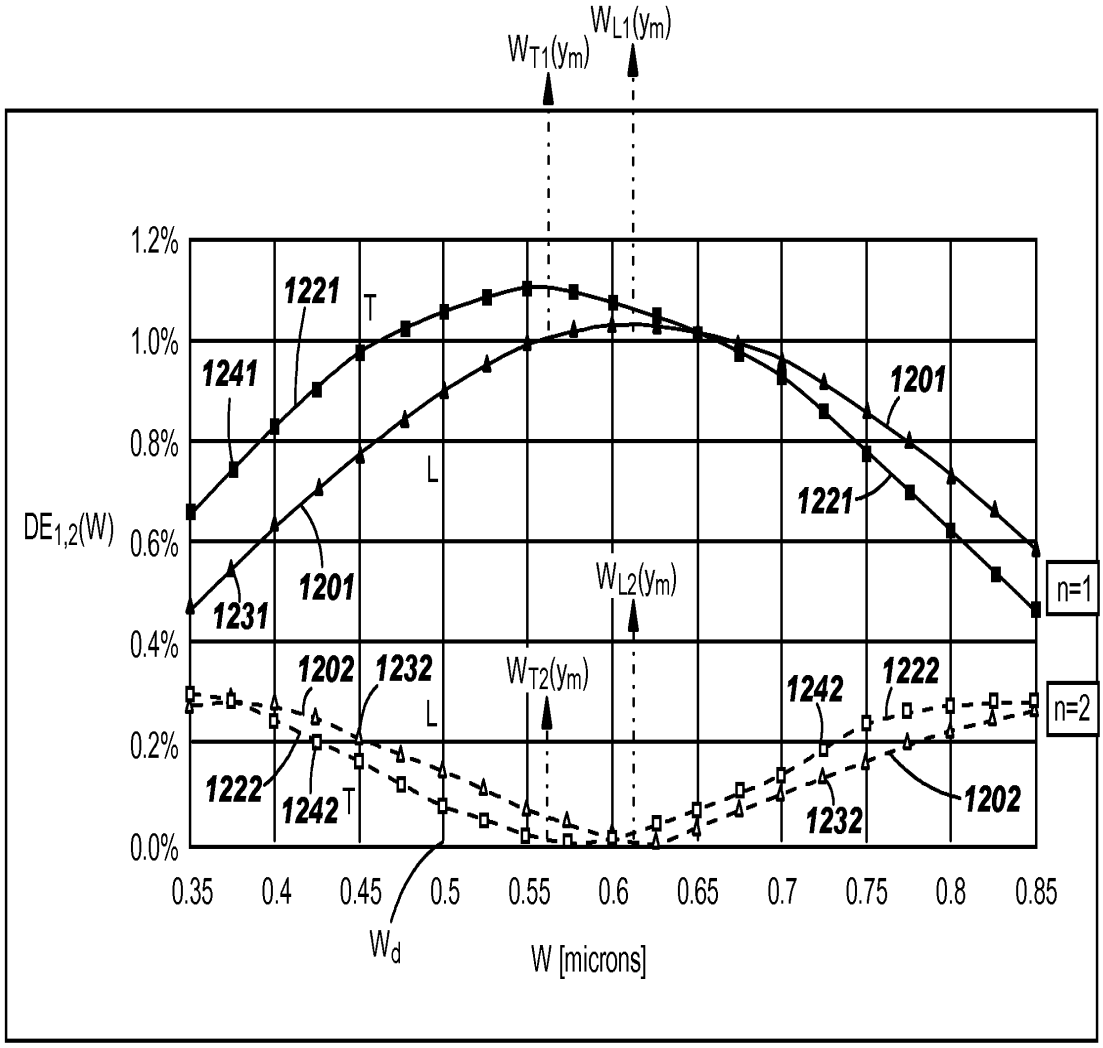

$W_{T1}(y_m)$
$W_{L1}(y_m)$
1.2%
1.0%
0.8%
0.6%
0.4%
0.2%
0.0%
$DE_{1,2}(W)$
1221
T
1241
L
1201
1231
1201
1221
$W_{L2}(y_m)$
$W_{T2}(y_m)$
1202
1232
L
1222
1242
T
1242
1222
1232
1202
n=1
n=2
0.35
0.4
0.45
0.5
0.55
0.6
0.65
0.7
0.75
0.8
0.85
W_d
W [microns]

FIG. 13A

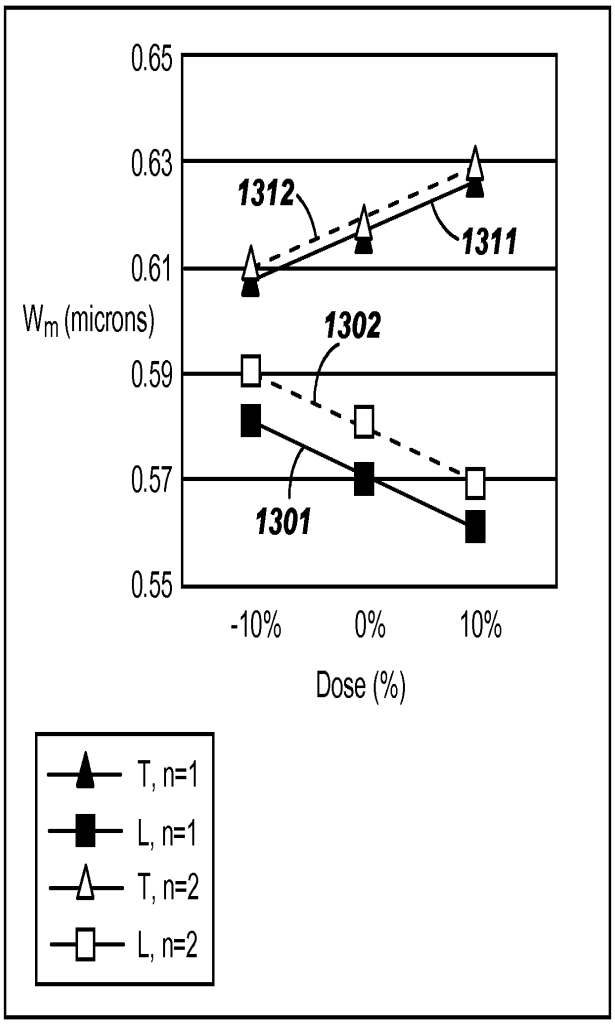


FIG. 13B

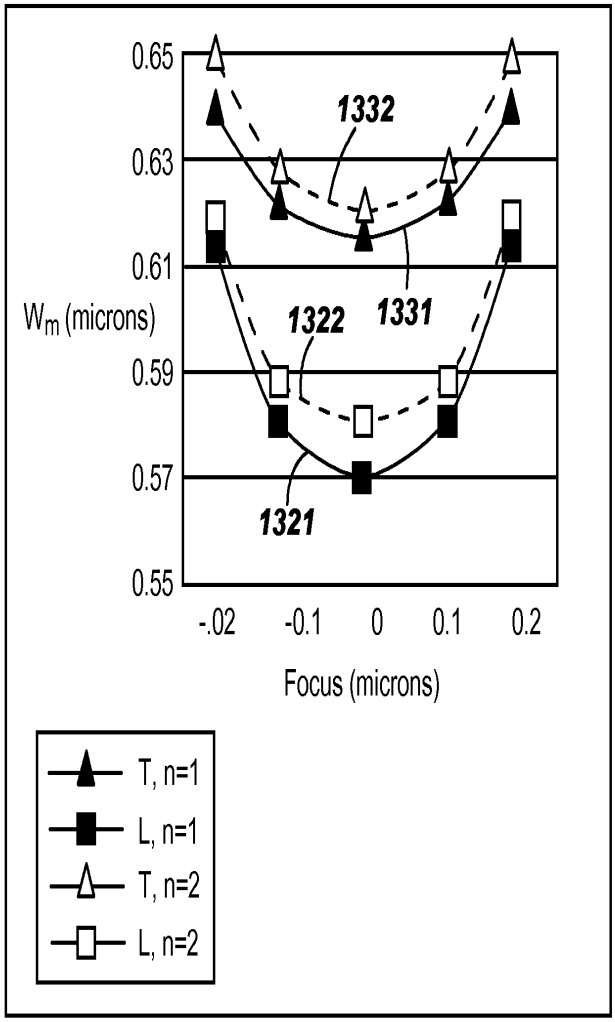


FIG. 14A

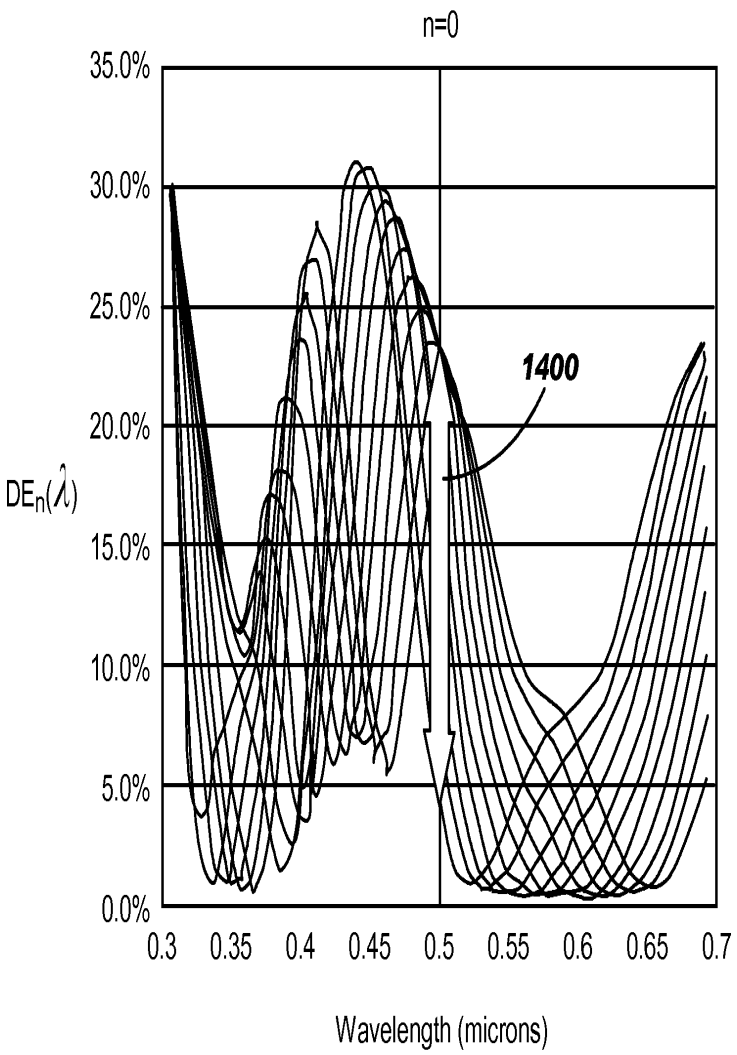


FIG. 14B

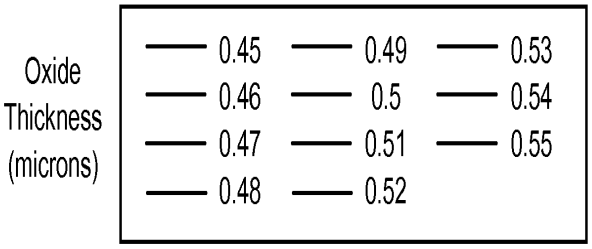


FIG. 15A

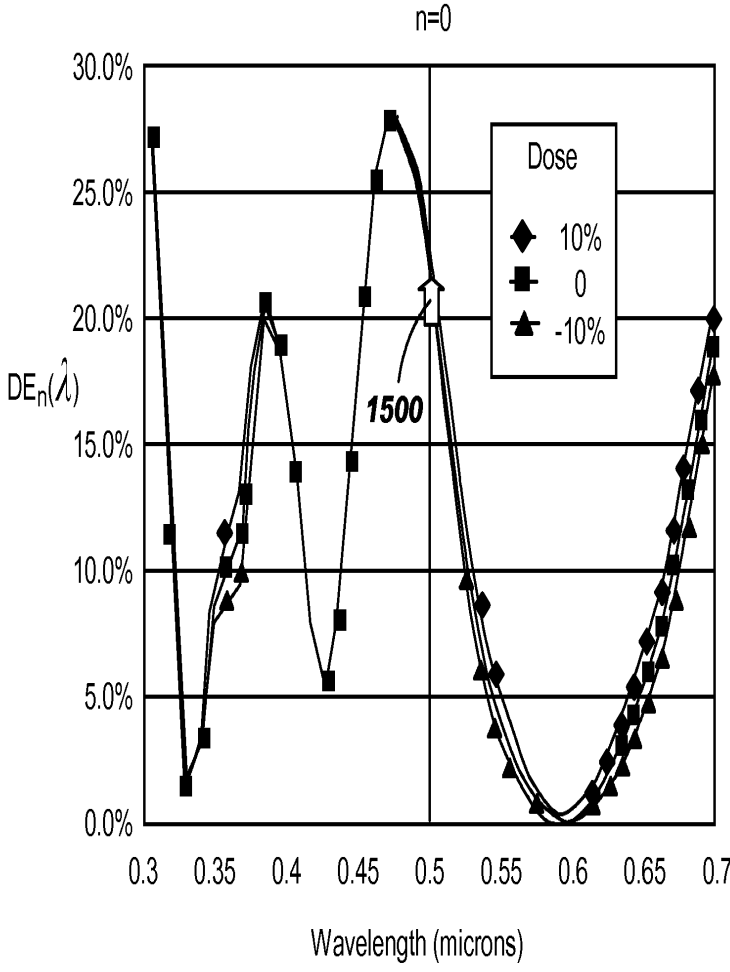


FIG. 15B

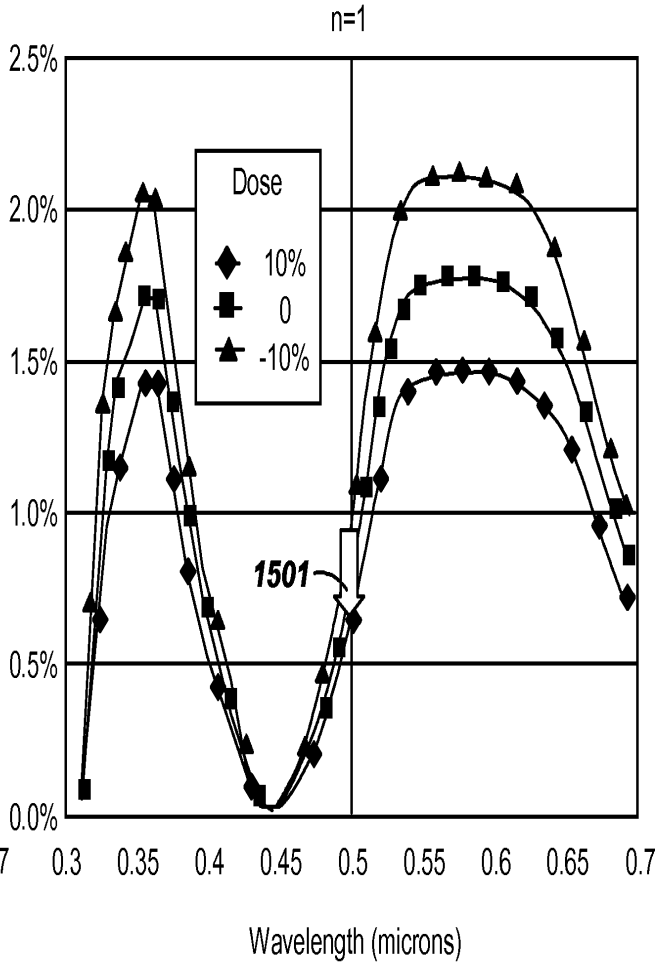


FIG. 16A

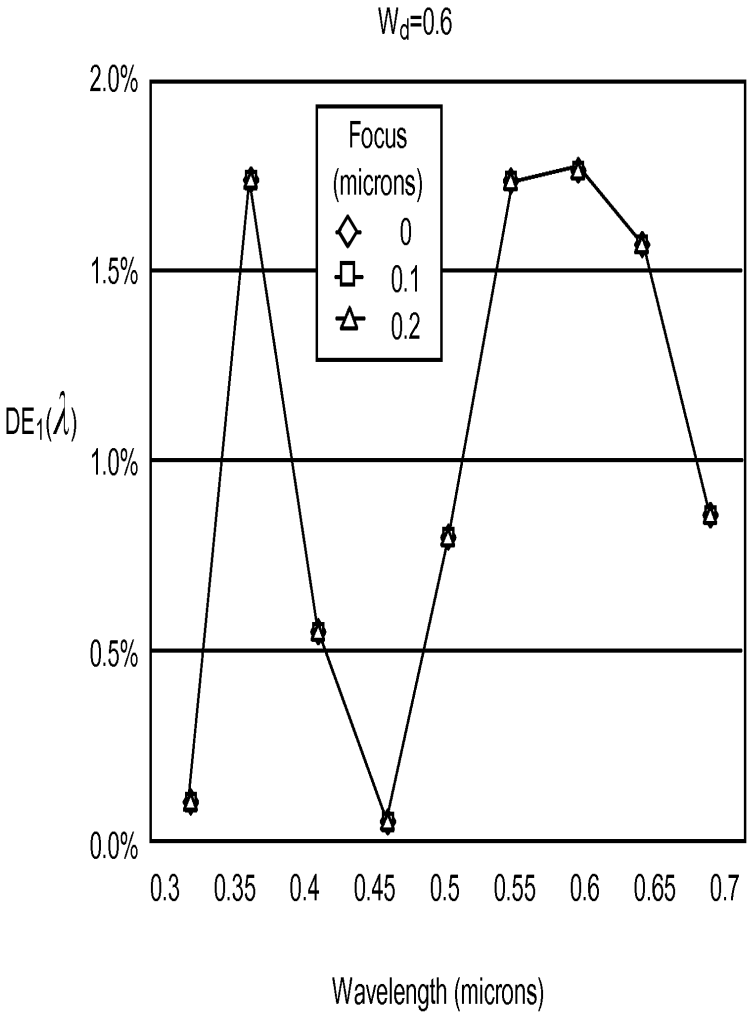


FIG. 16B

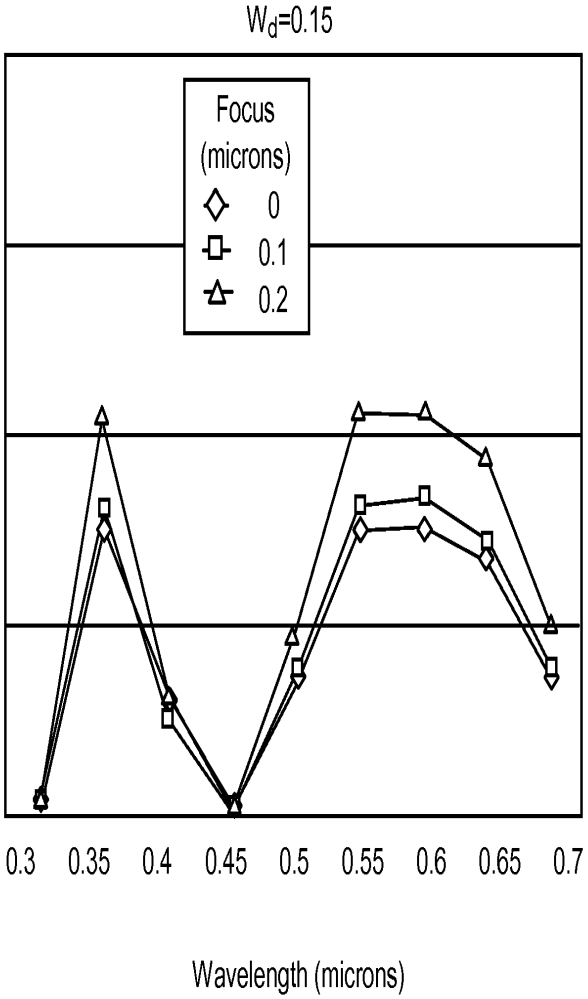


FIG. 17

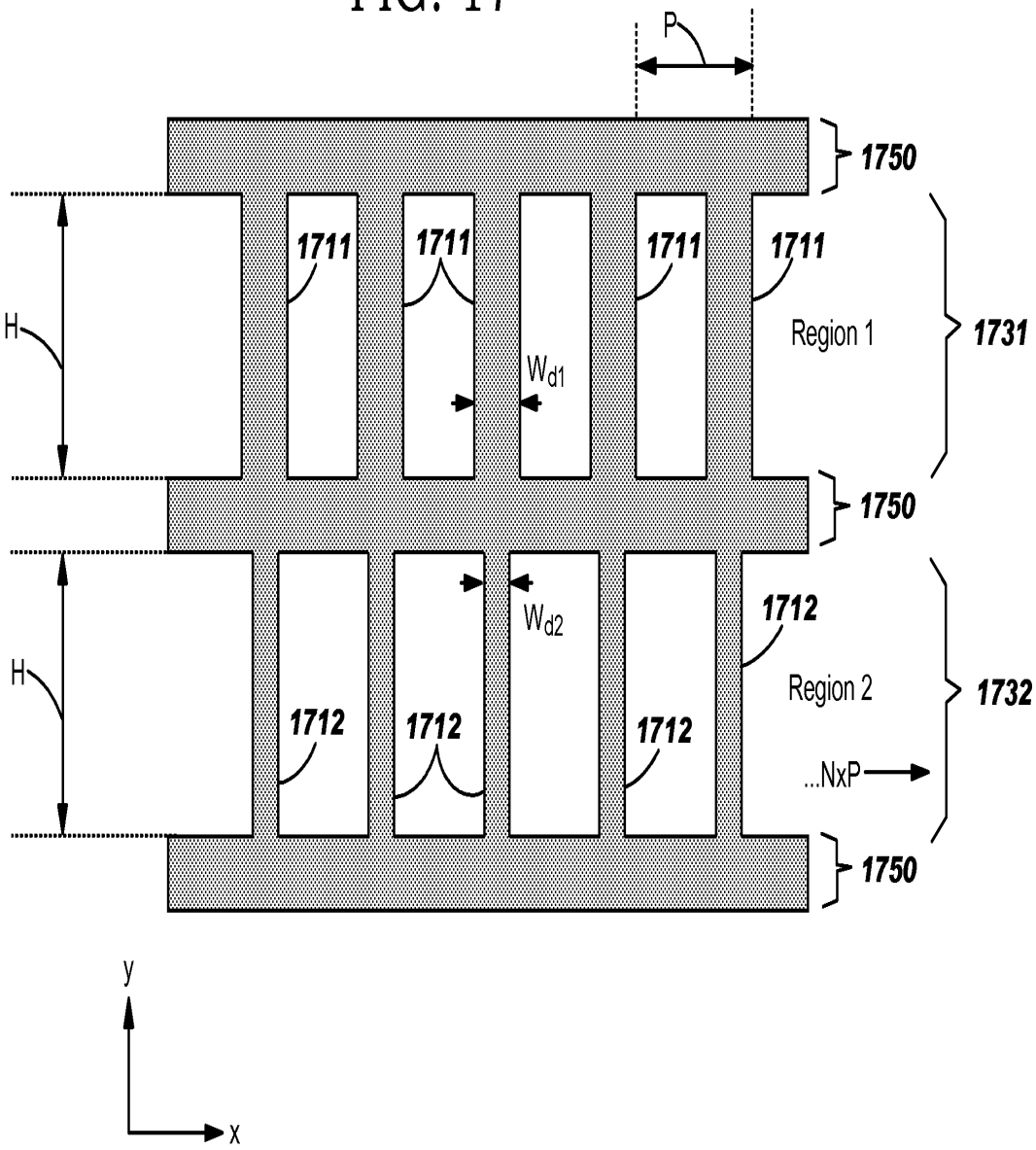

P
1750
1711
1711
1711
1711
H
Region 1
1731
W_{d1}
1750
W_{d2}
1712
H
1712
1712
1712
Region 2
1732
...NxP
1750
y
x

FIG. 18A

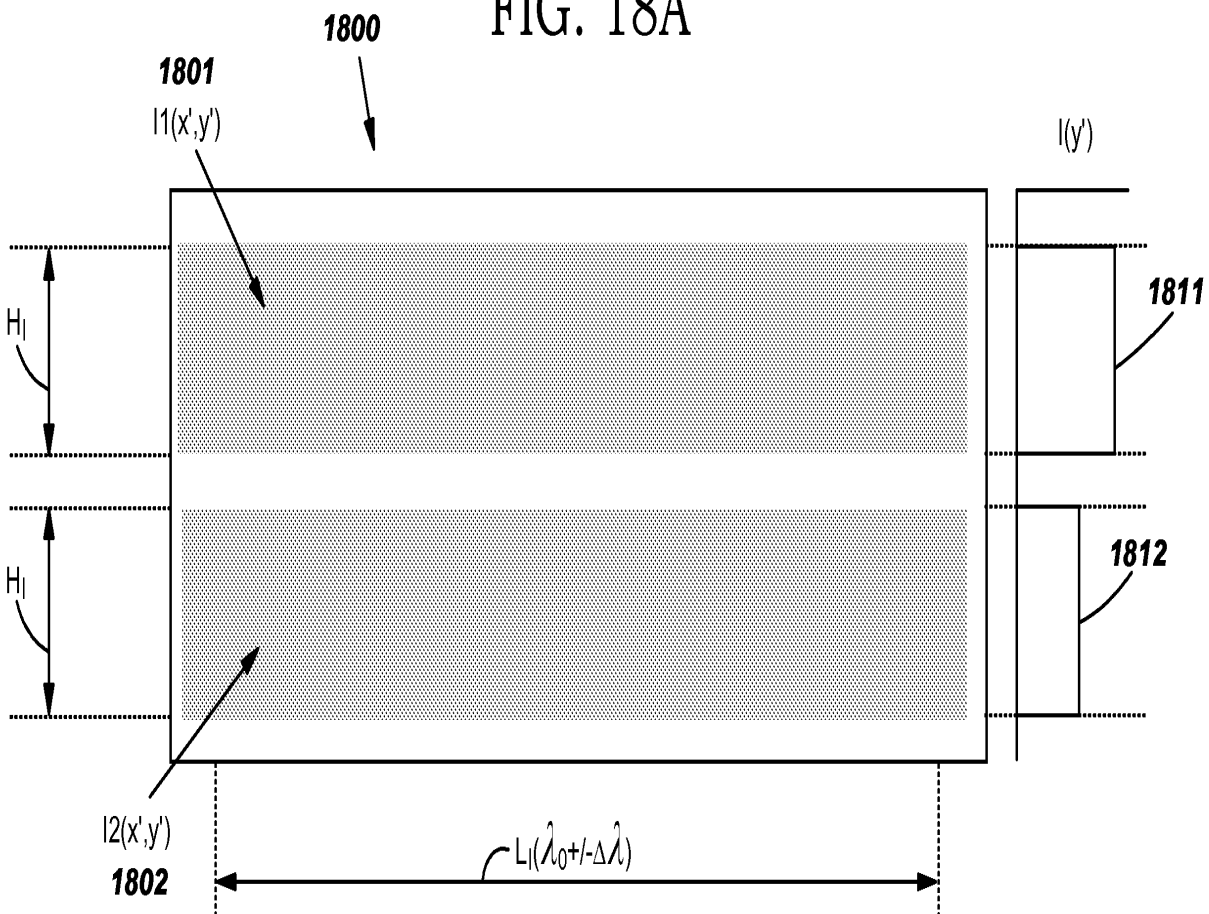


FIG. 18B

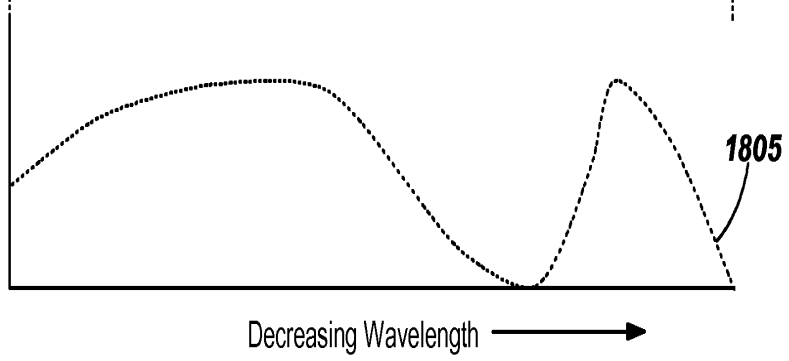


FIG. 19

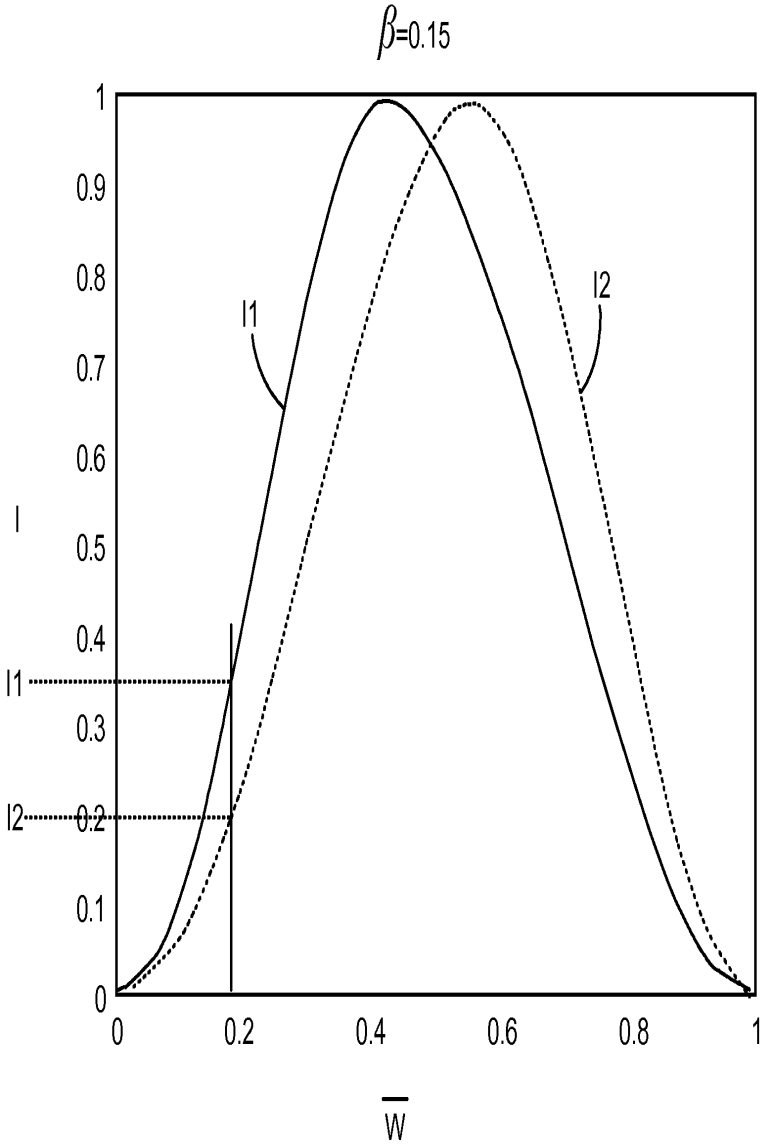


FIG. 20

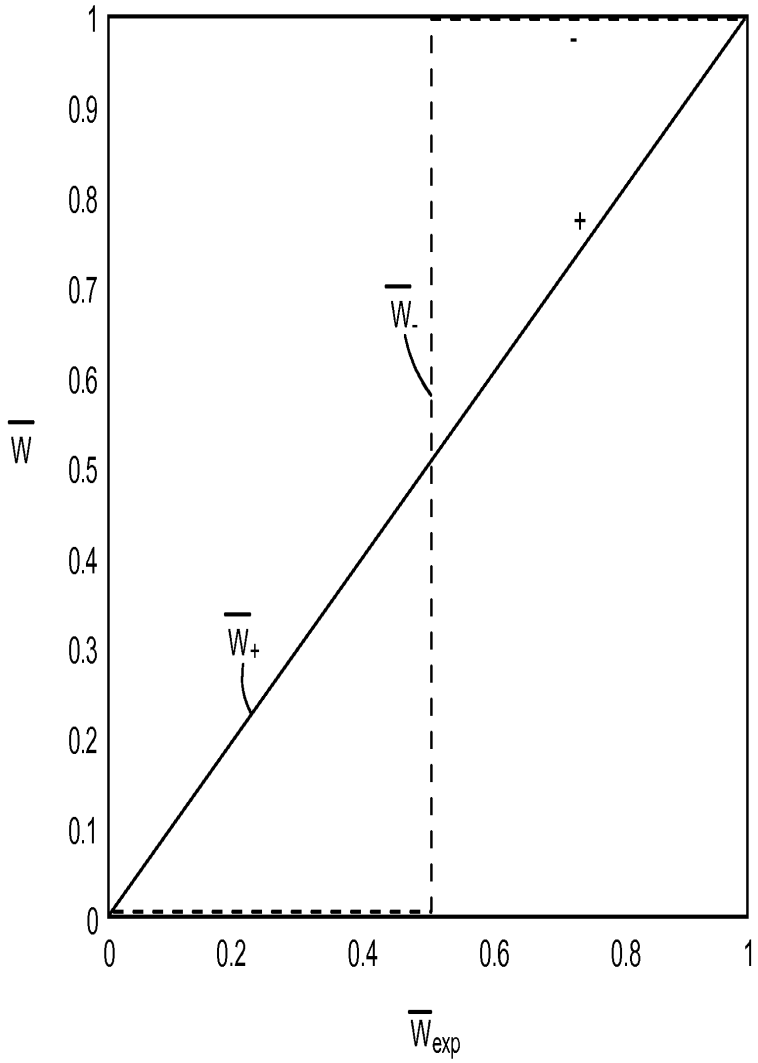


FIG. 21

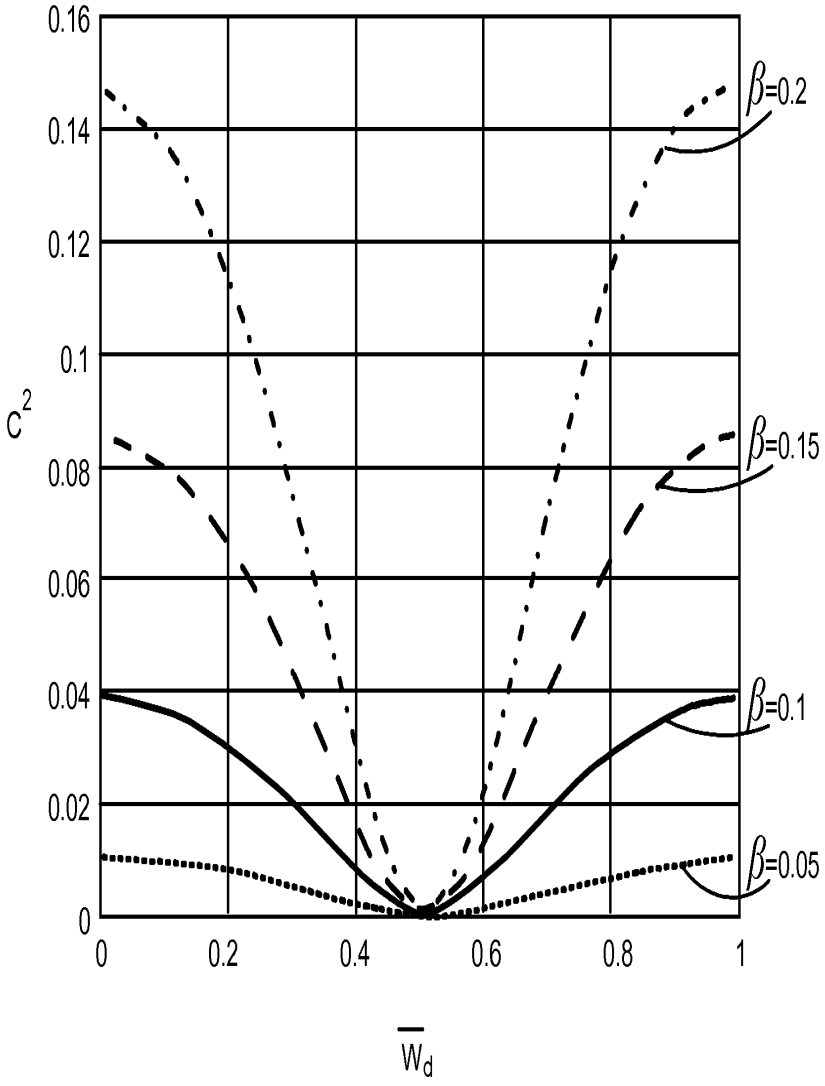

0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
C^2
0
0.2
0.4
0.6
0.8
1
$\overline{W}_d$
β=0.2
β=0.15
β=0.1
β=0.05

FIG. 22A

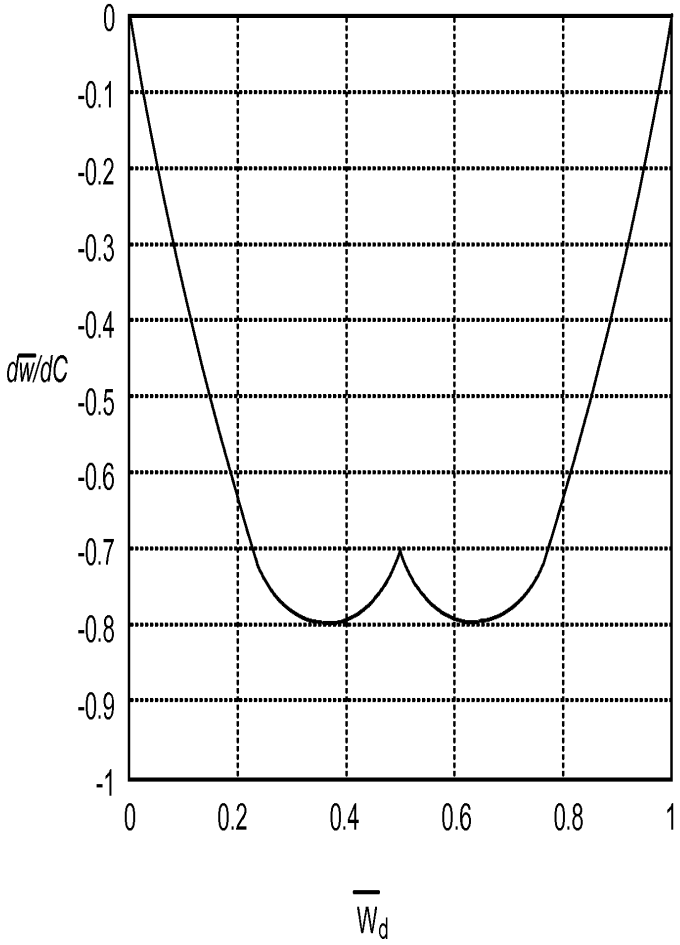


FIG. 22B

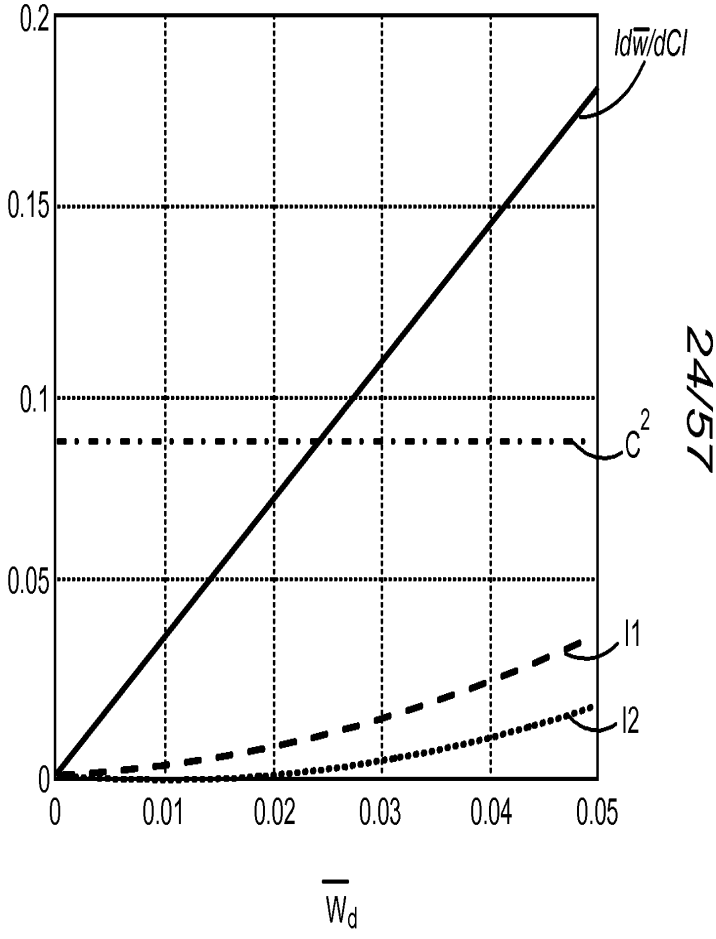


FIG. 23

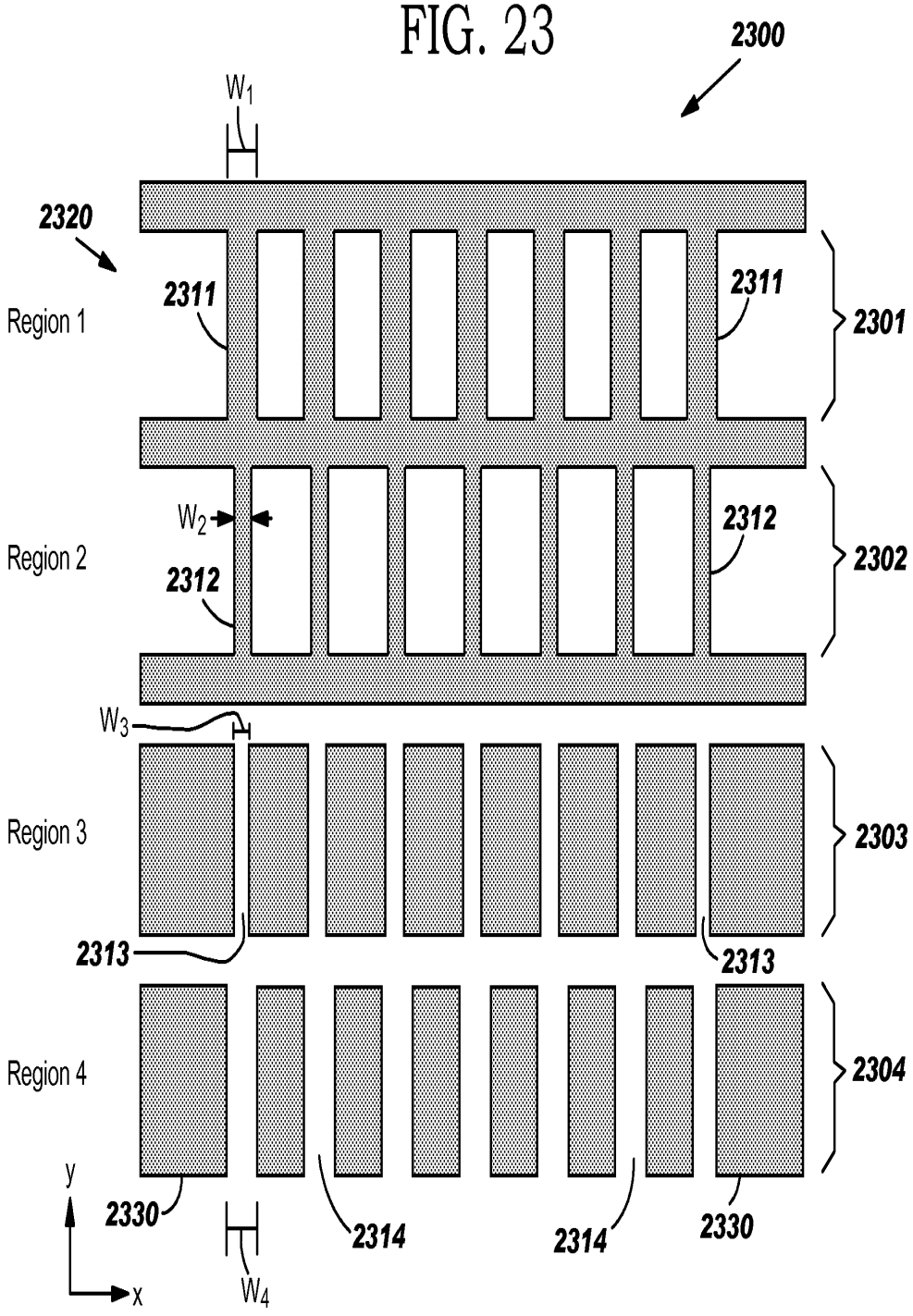

2300
W1
2320
2311
2311
Region 1
2301
W2
2312
2312
Region 2
2302
W3
Region 3
2303
2313
2313
Region 4
2304
y
2330
2314
2314
2330
x
W4

FIG. 24A

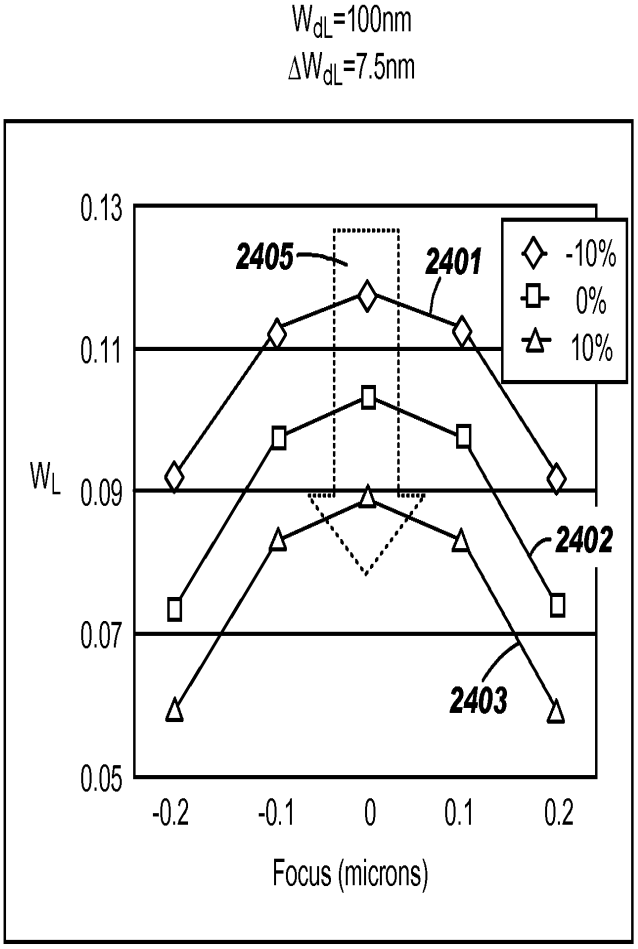


FIG. 24B

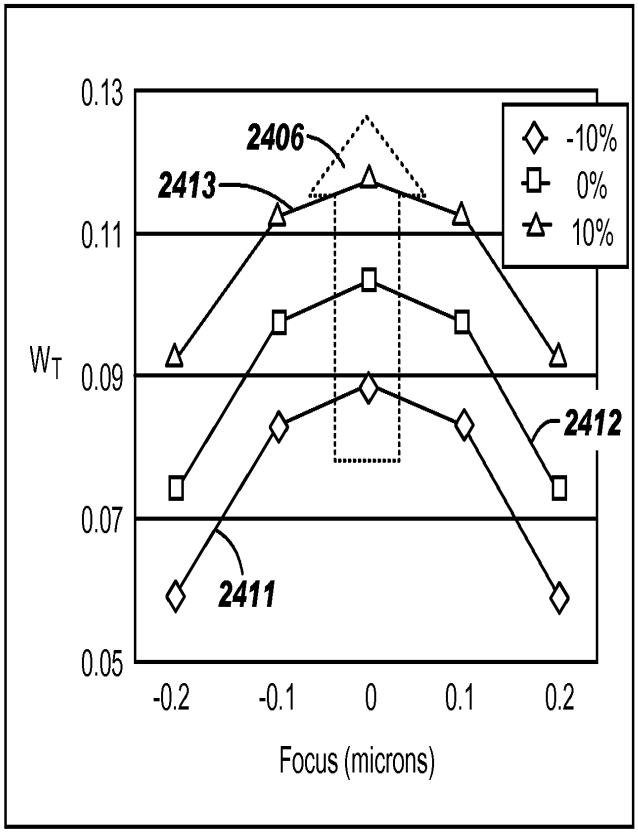


FIG. 25

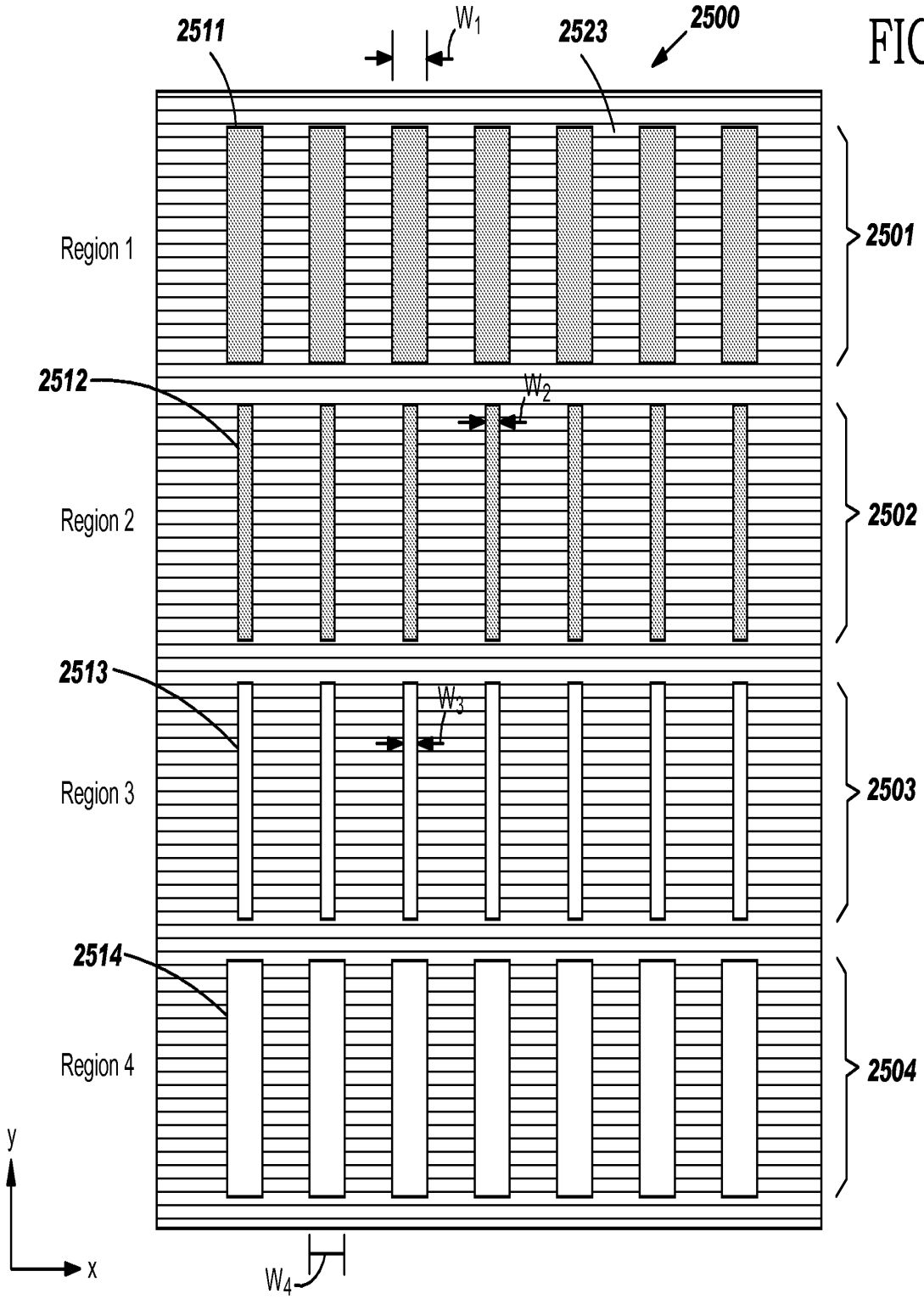

2511
W1
2523
2500
Region 1
2501
2512
W2
Region 2
2502
2513
W3
Region 3
2503
2514
Region 4
2504
y
x
W4

FIG. 26A

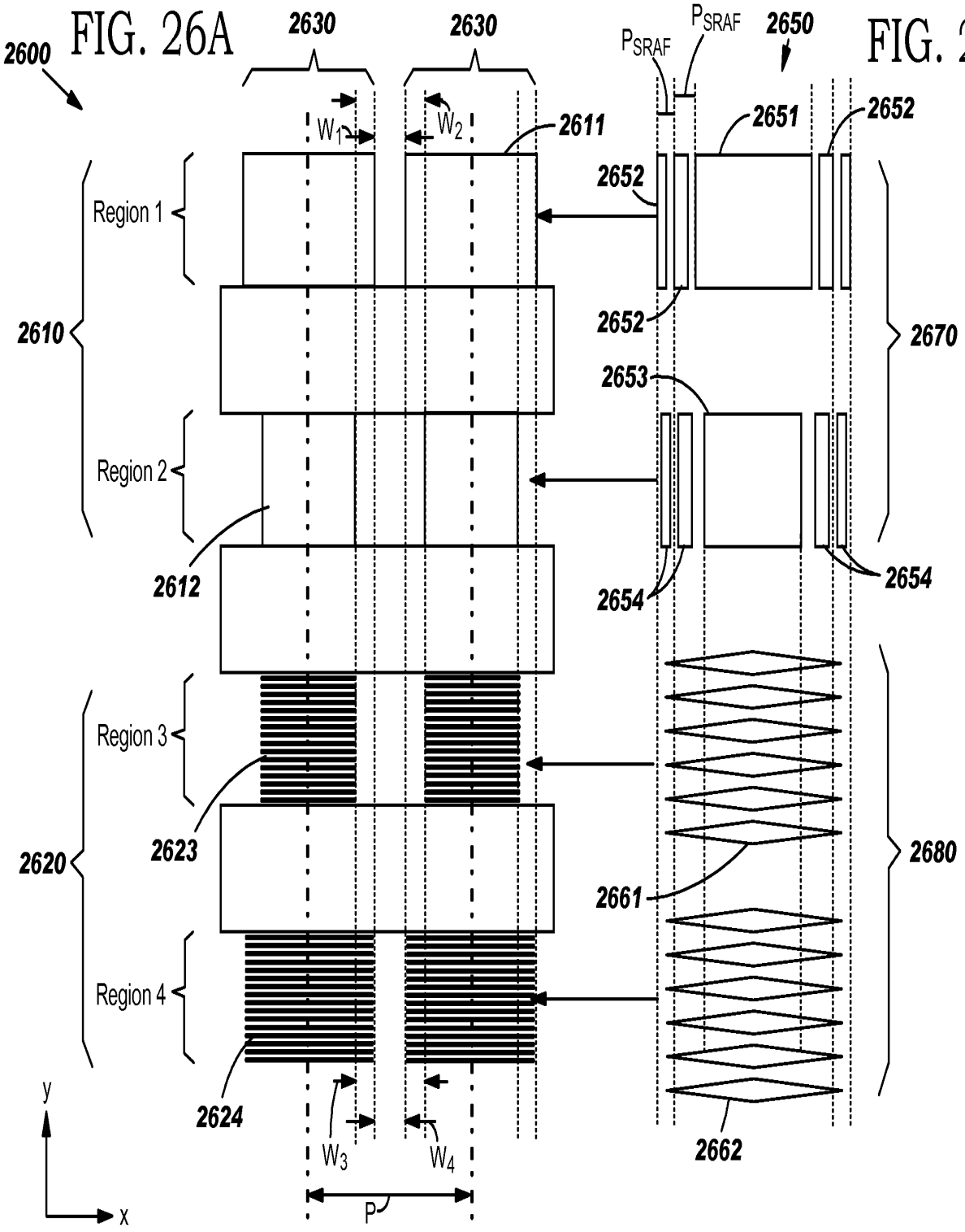


FIG. 26B

FIG. 27A

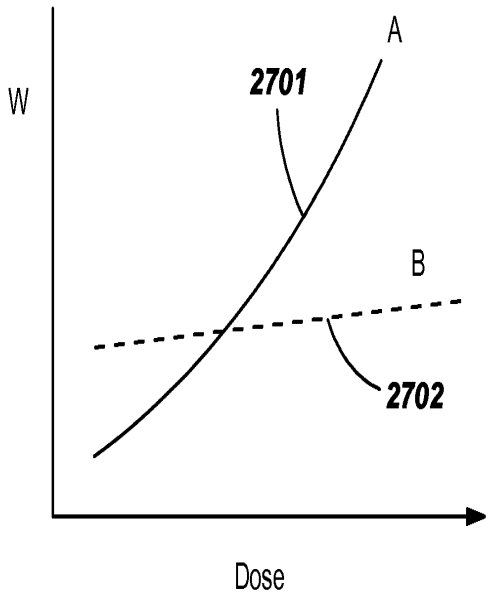


FIG. 27B

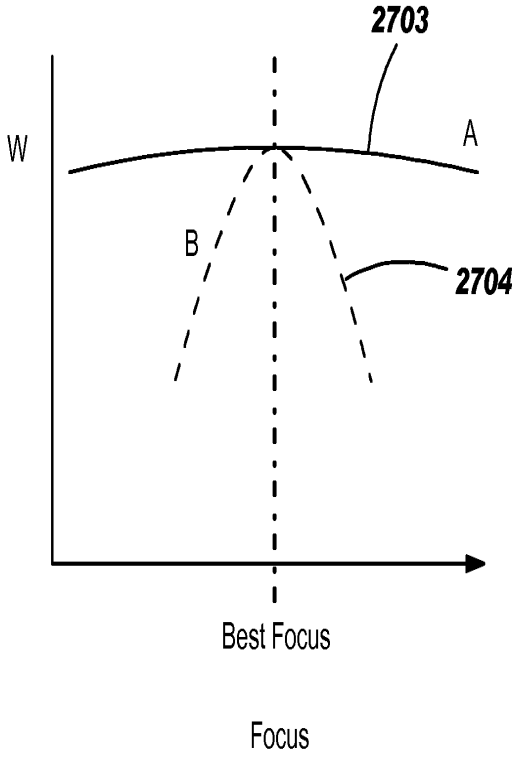


FIG. 28

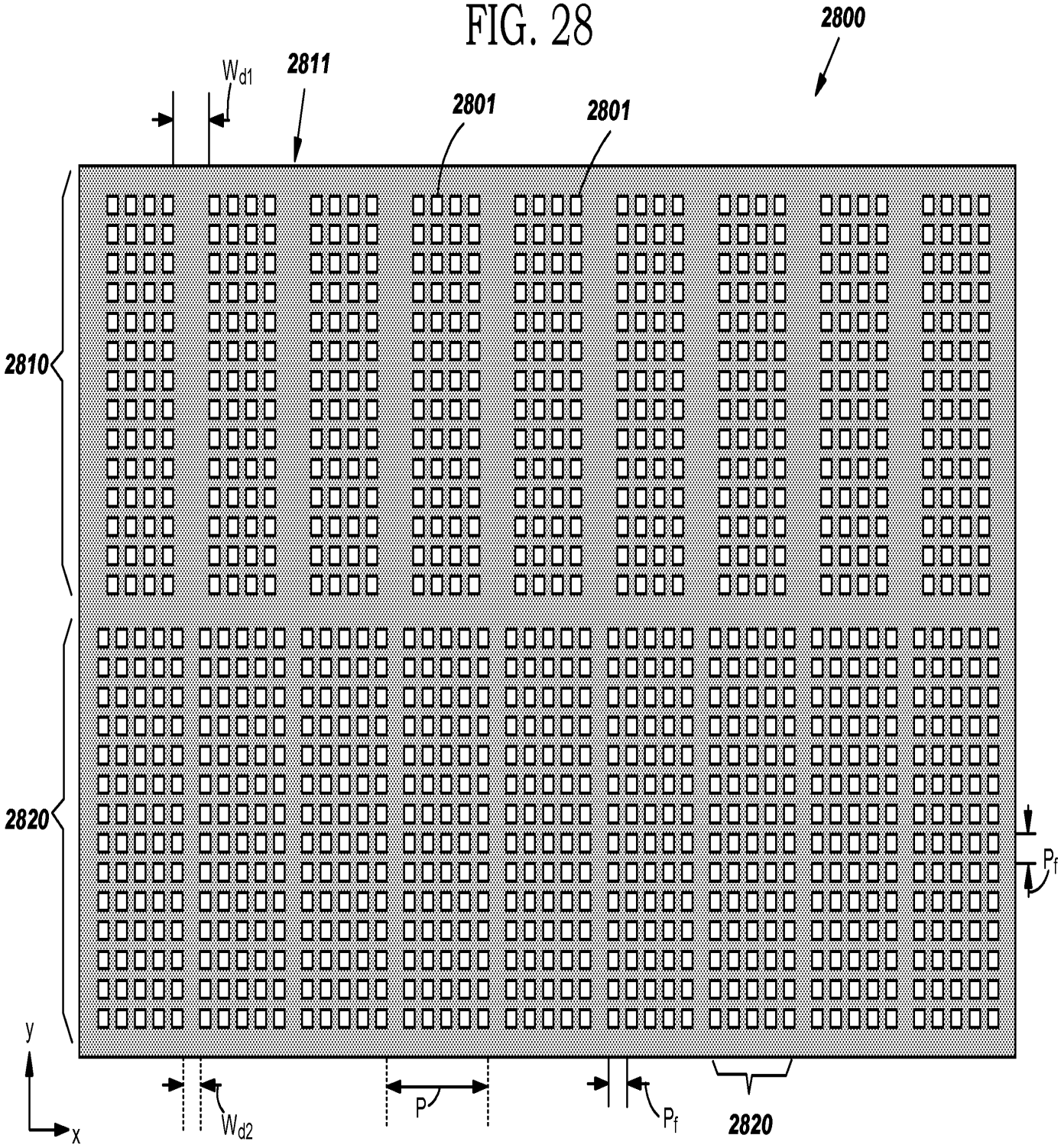


FIG. 29

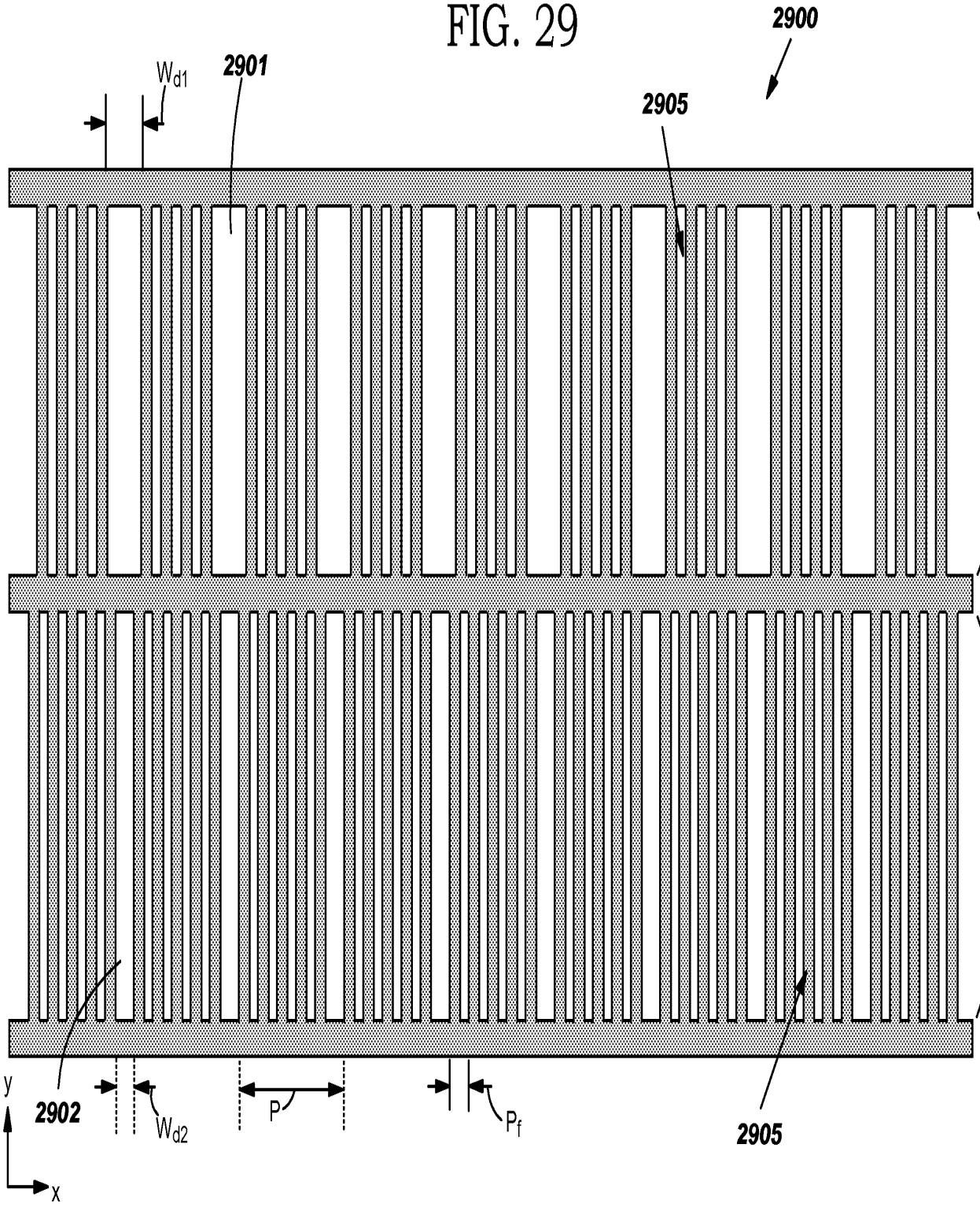


FIG. 30

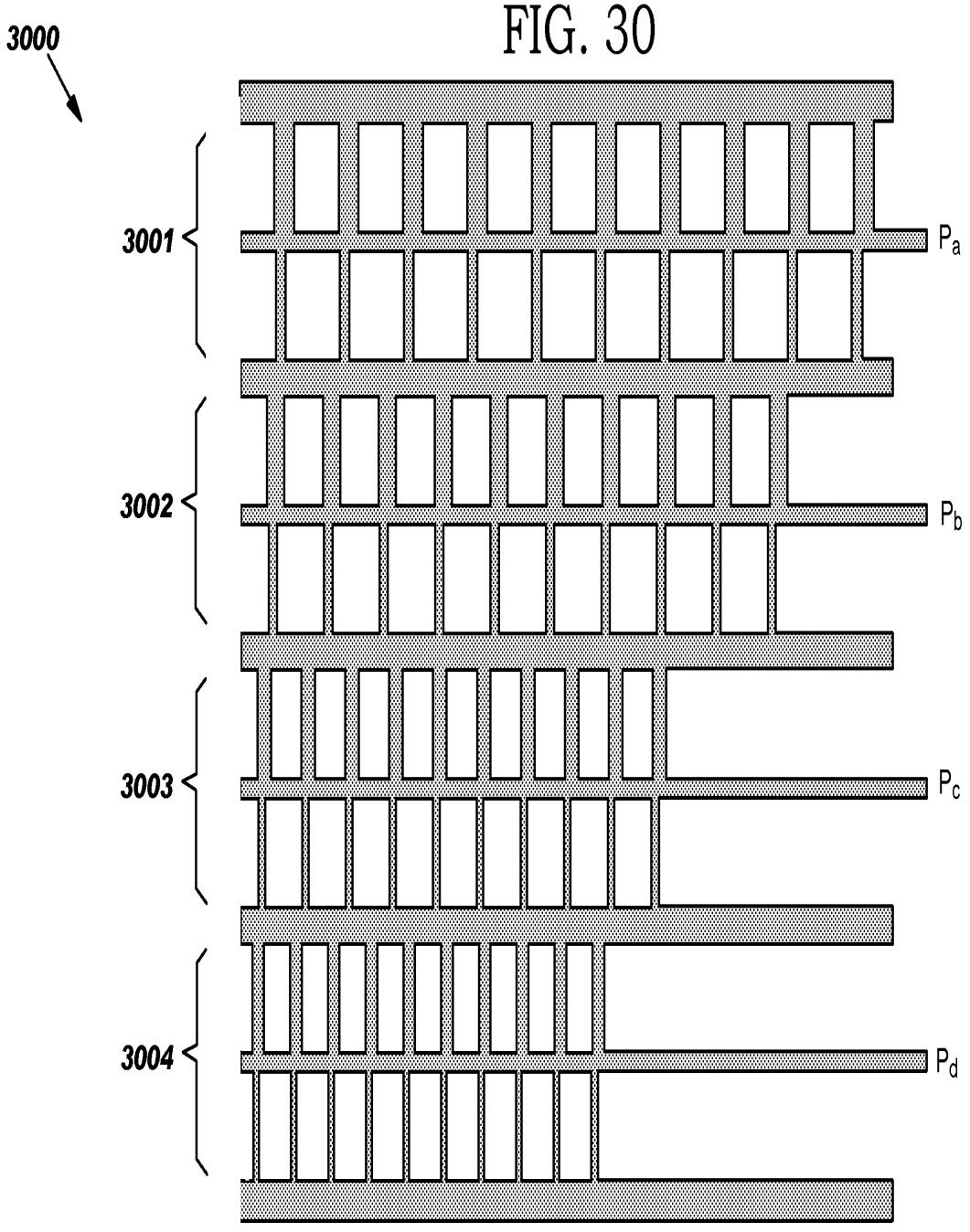


FIG. 31

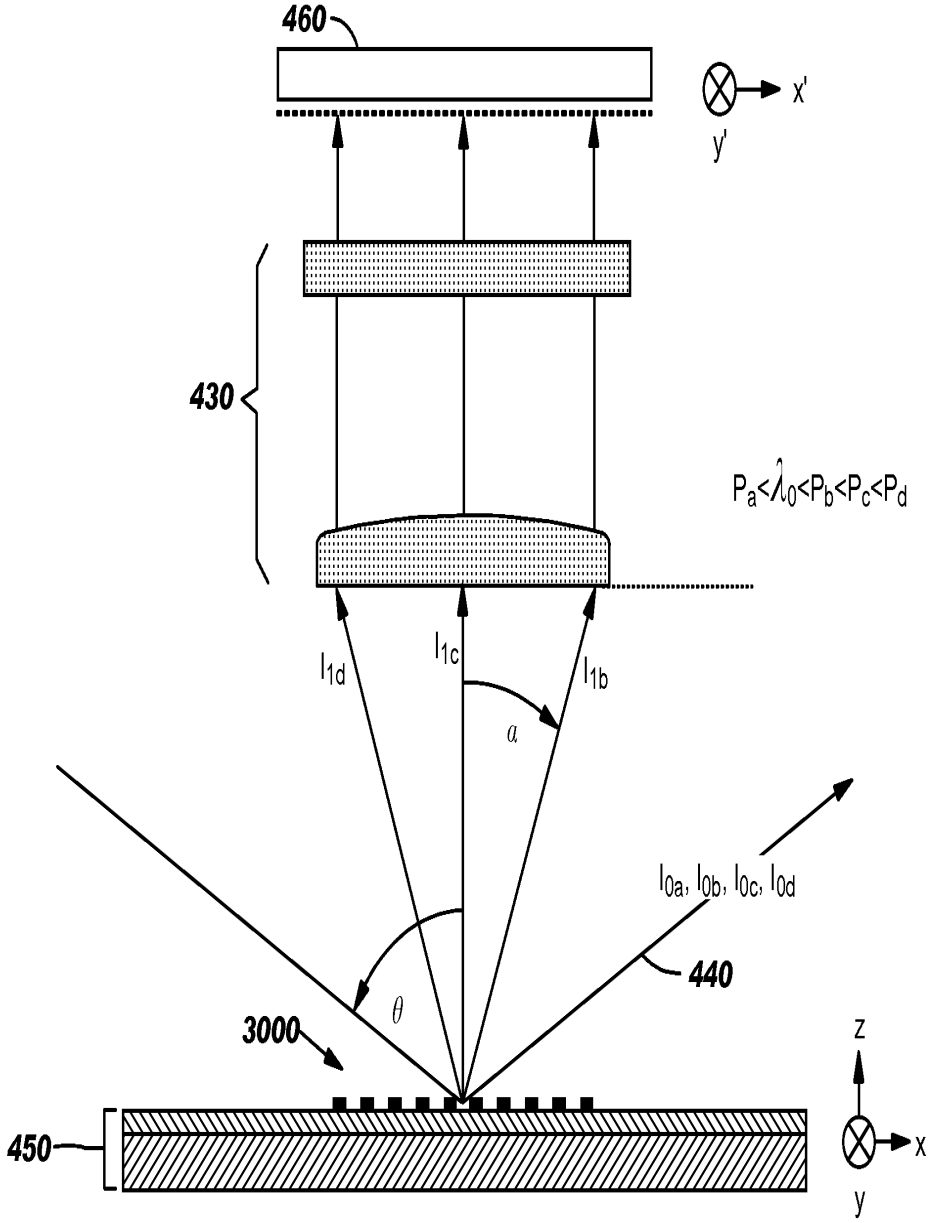

460
x'
y'
430
$P_a<\lambda_0<P_b<P_c<P_d$
I_{1d}
I_{1c}
I_{1b}
a
$I_{0a}, I_{0b}, I_{0c}, I_{0d}$
440
θ
3000
450
z
x
y

FIG. 32A

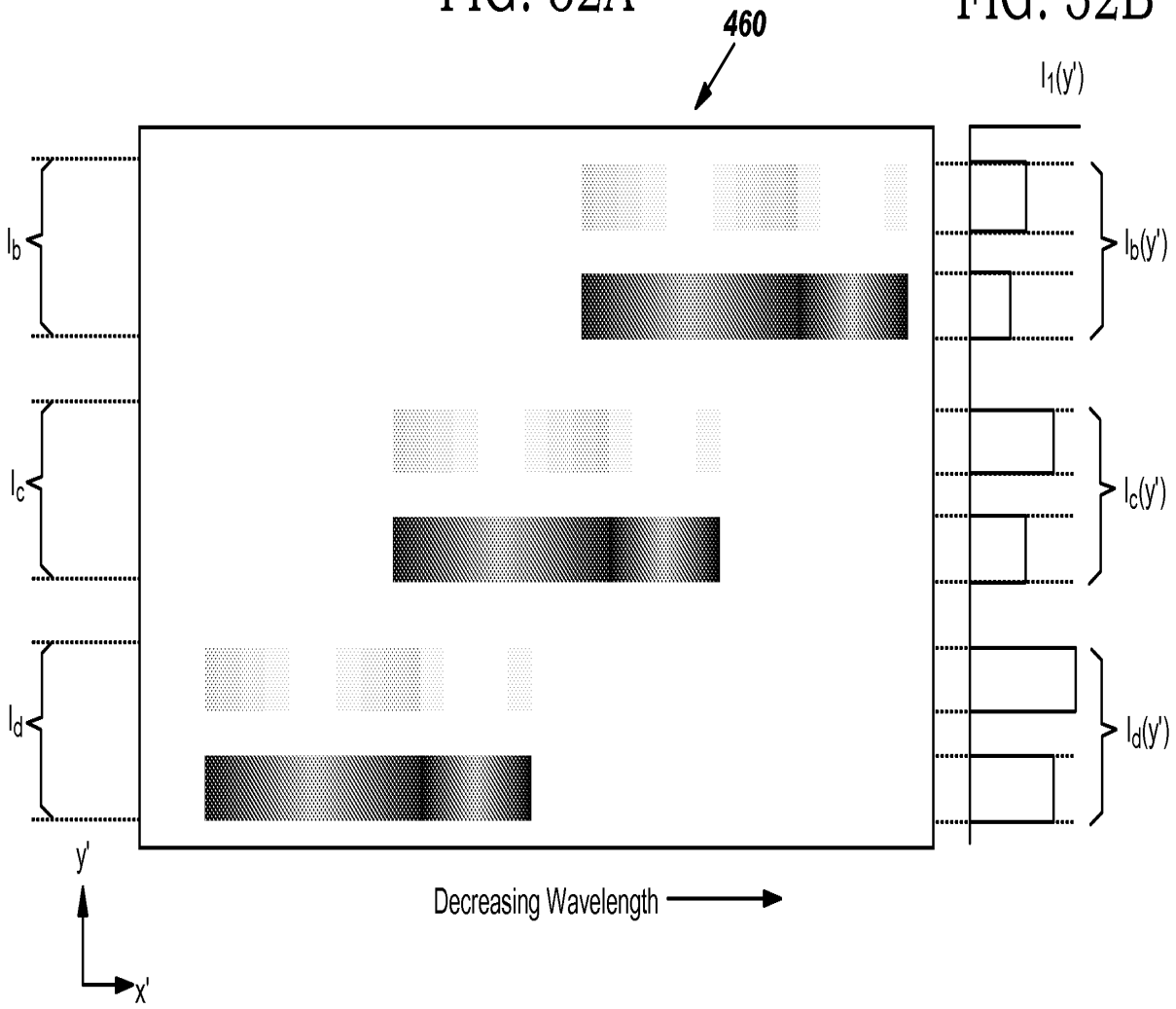


FIG. 32B

FIG. 33A

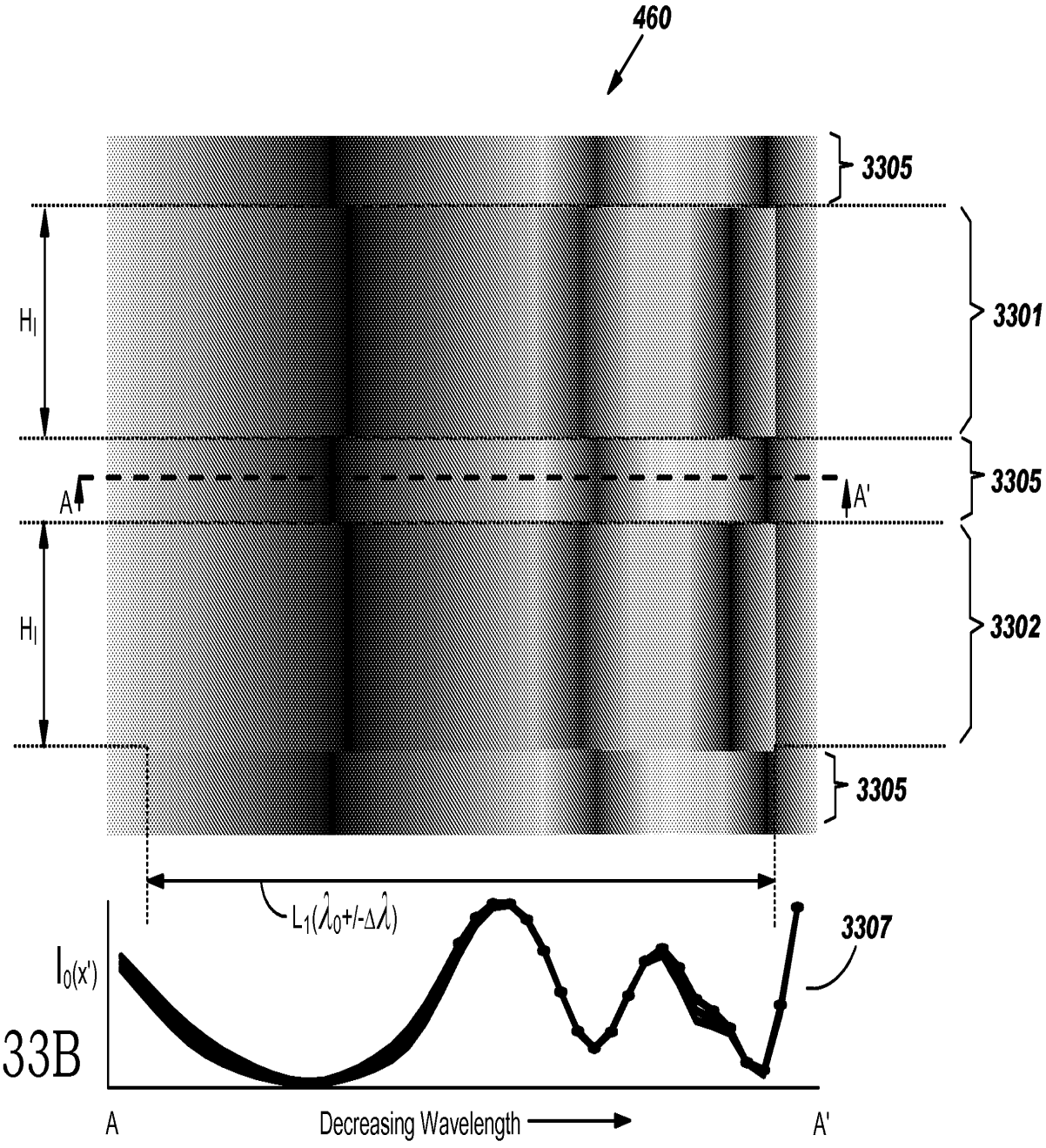


FIG. 33B

FIG. 34A

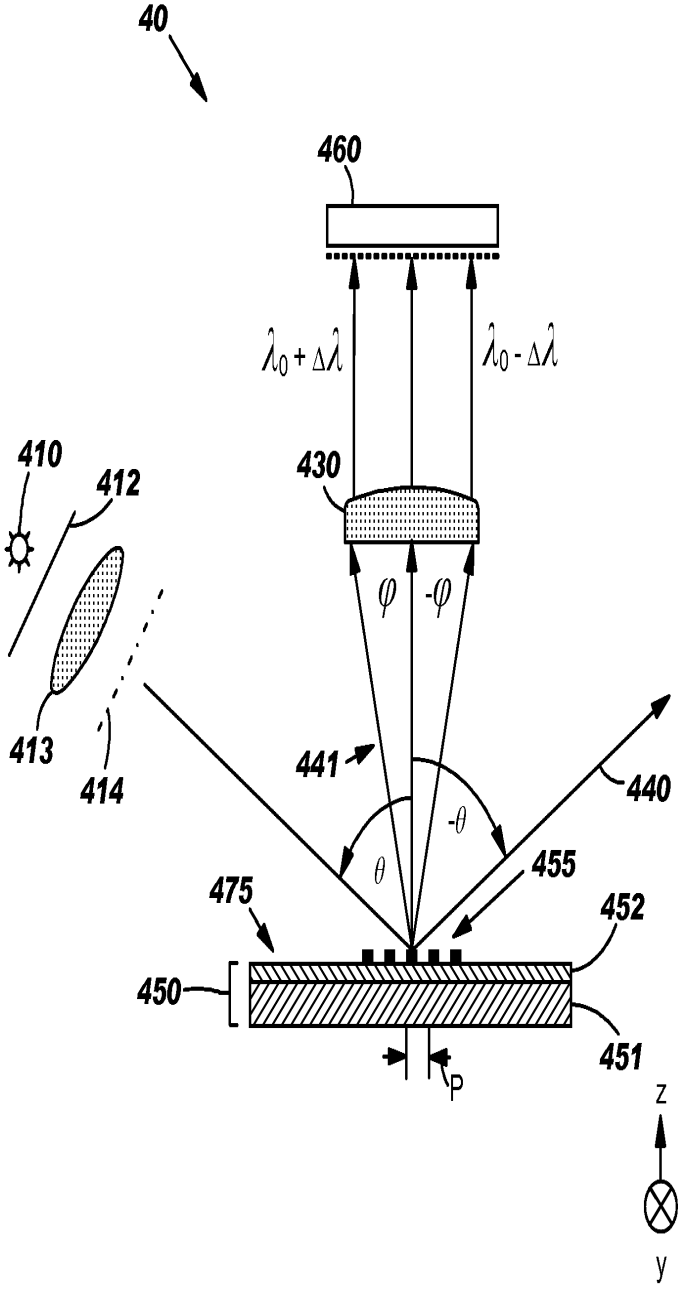


FIG. 34B

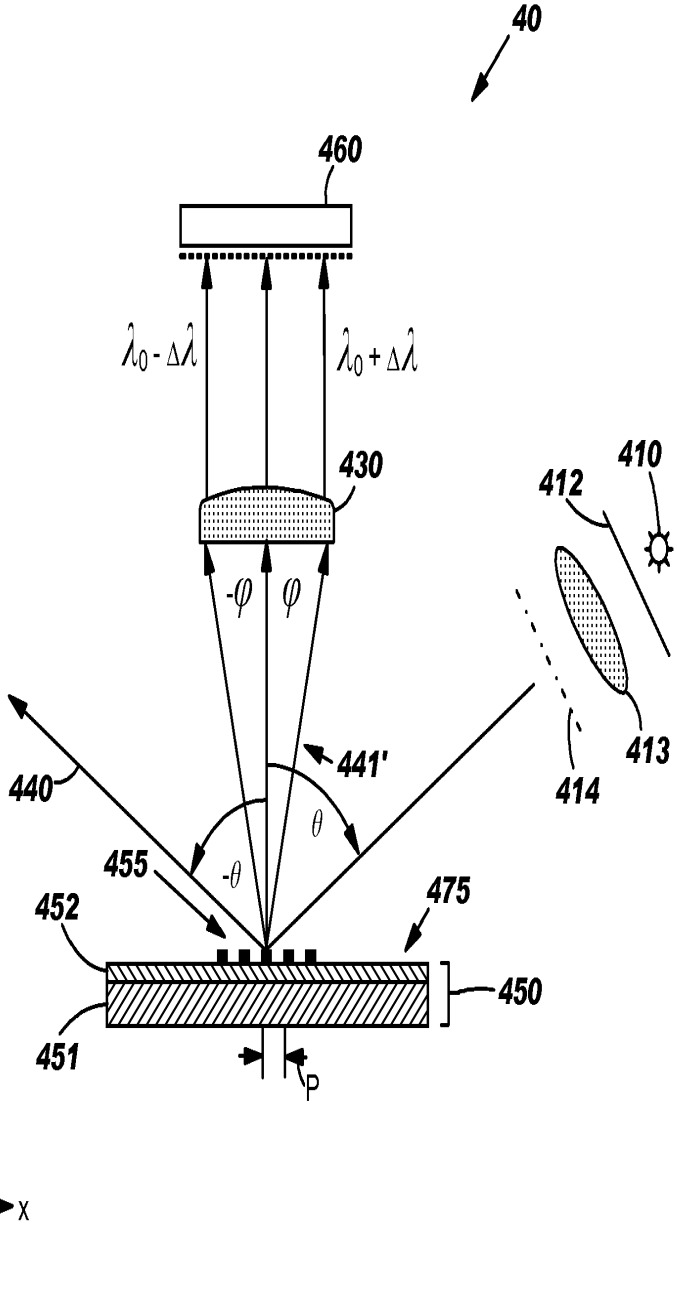


FIG. 35A

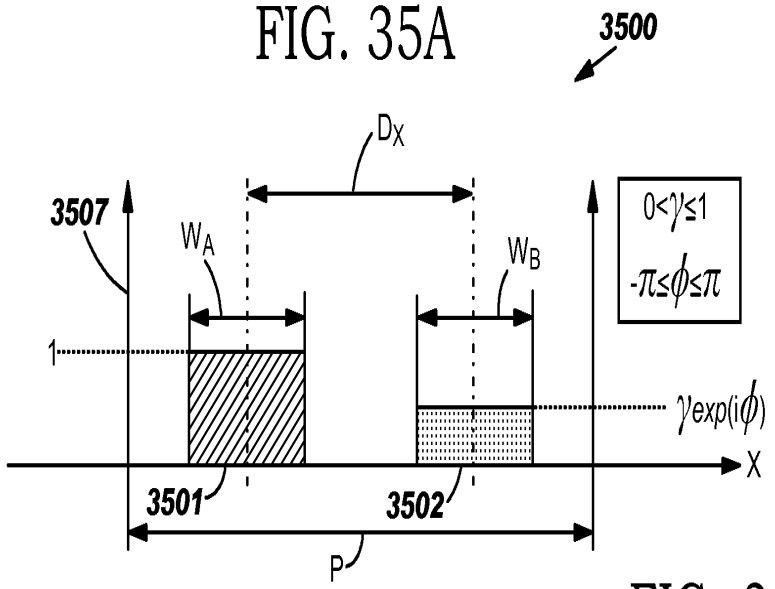


FIG. 35B

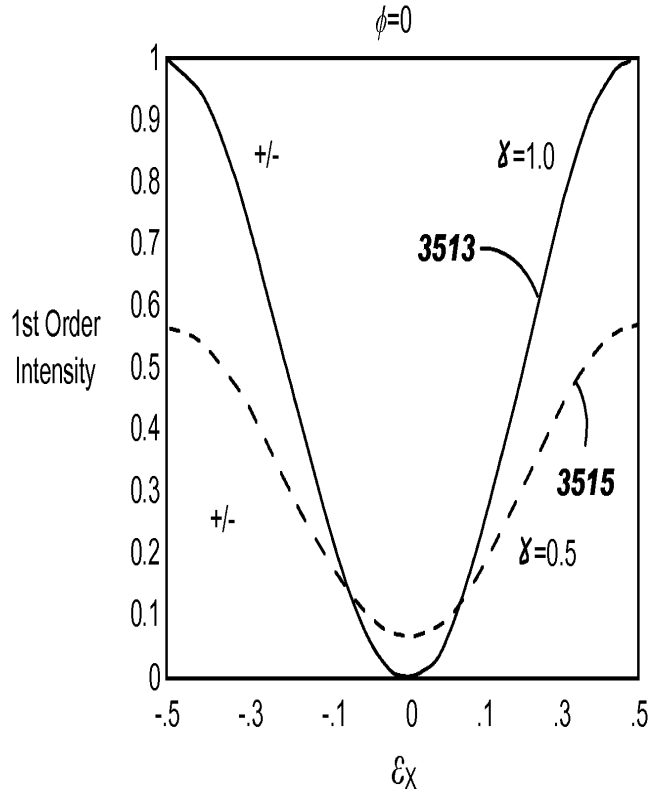


FIG. 35C

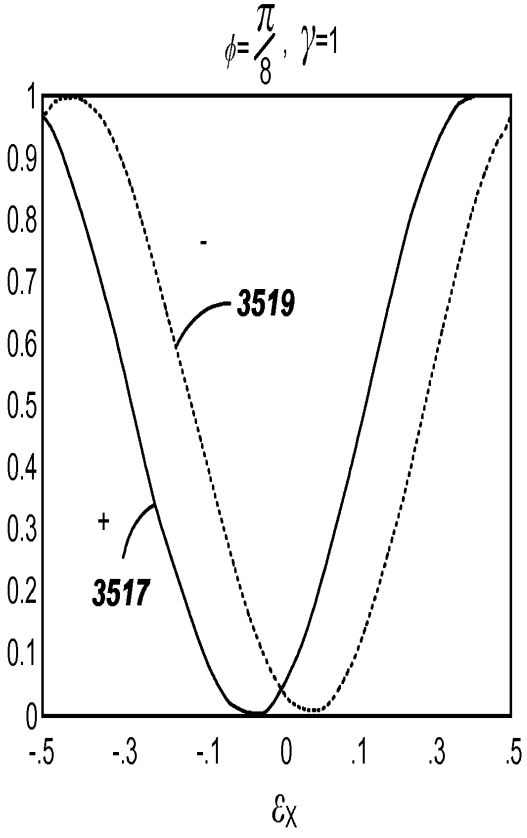


FIG. 36

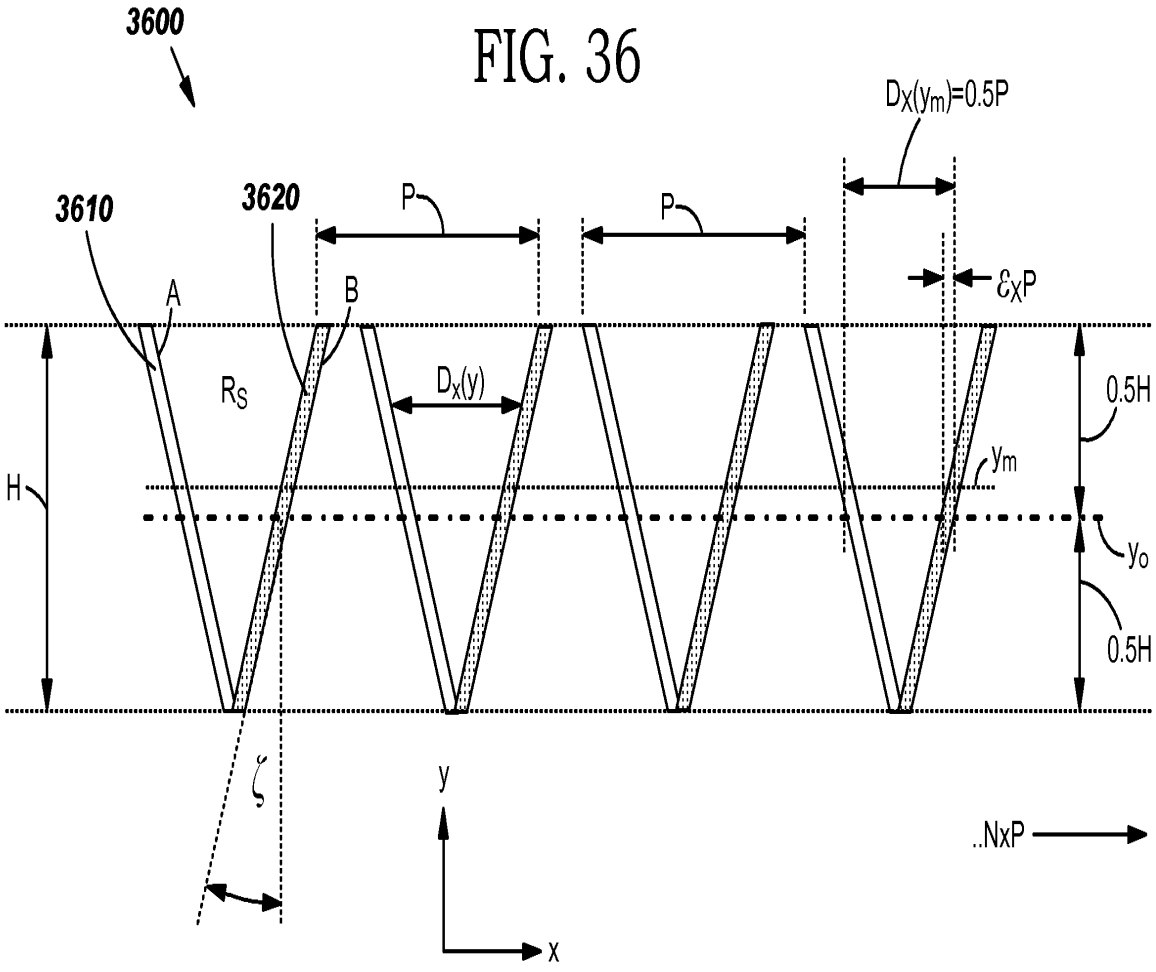

3600
3610
3620
A
B
P
P
$D_X(y_m)$=0.5P
ε_XP
R_S
$D_x(y)$
H
0.5H
y_m
y_o
0.5H
ζ
y
x
..NxP

FIG. 37A

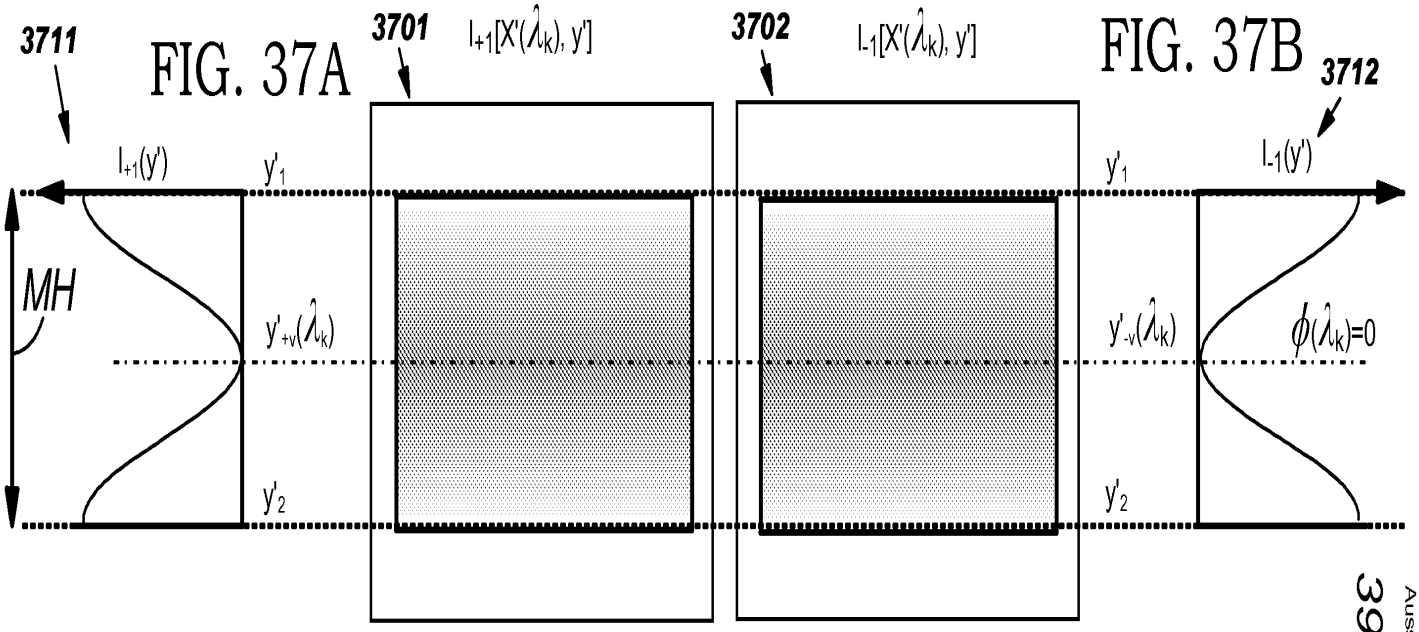


FIG. 37B

FIG. 37C

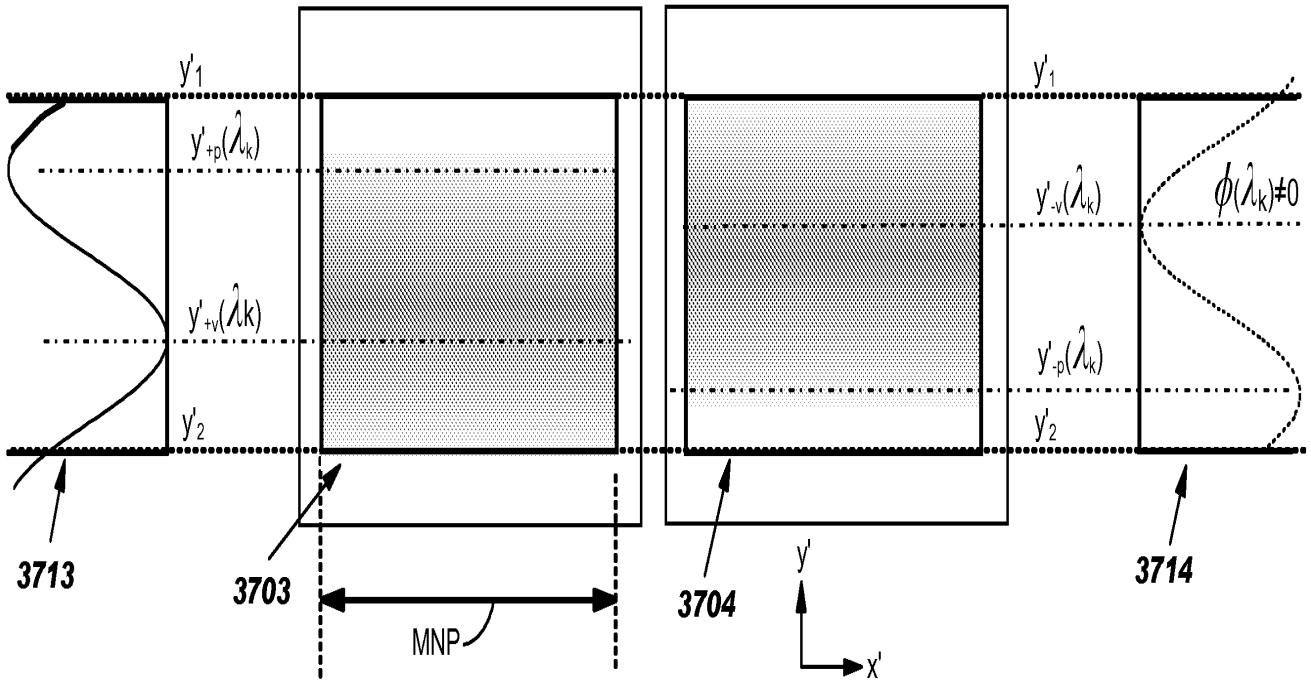


FIG. 37D

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FIG. 38A

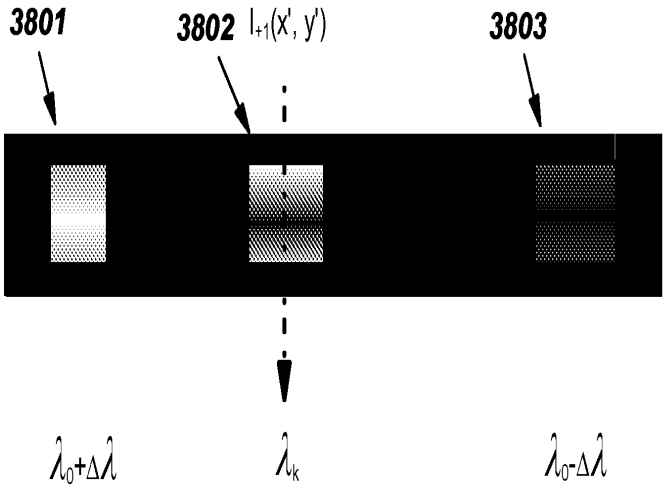

FIG. 38C

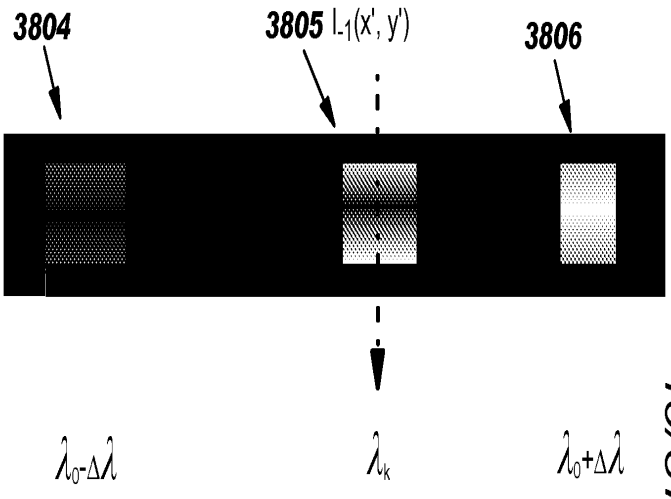

FIG. 38B

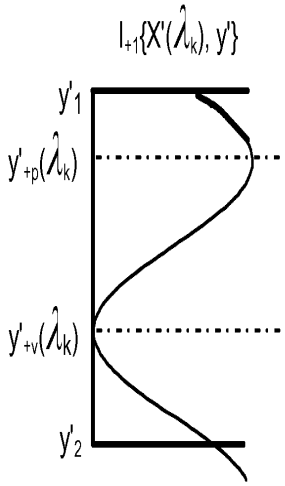

FIG. 38D

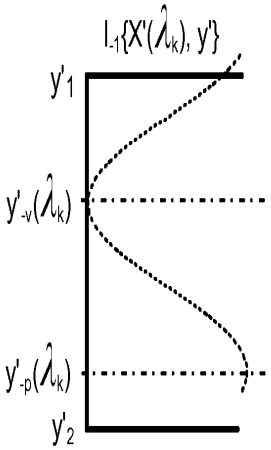

FIG. 39

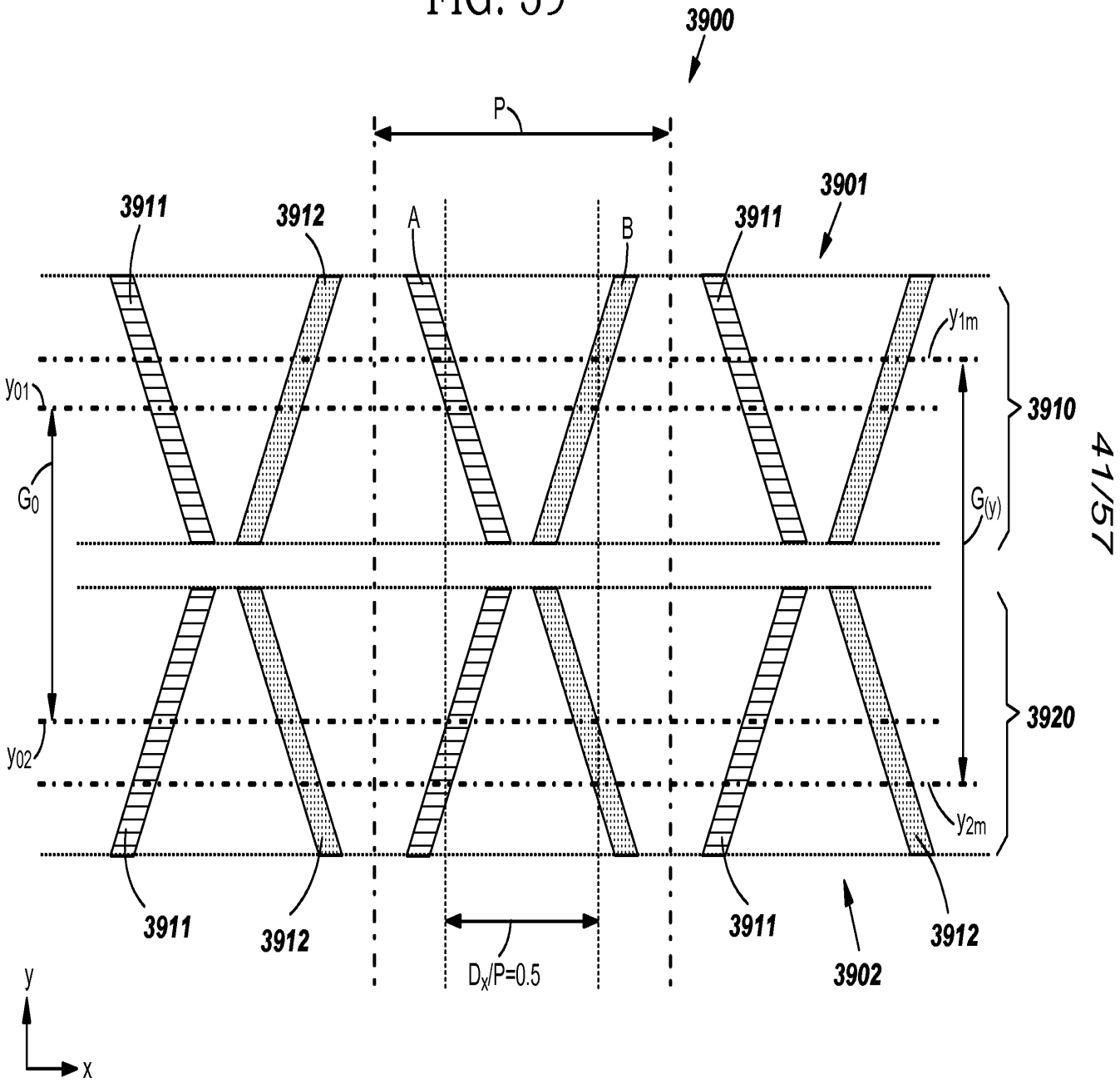
3900
P
3901
3911
3912
A
B
3911
y1m
y01
3910
G0
G(y)
3920
y02
y2m
3911
3912
Dx/P=0.5
3911
3902
3912
y
x

FIG. 40

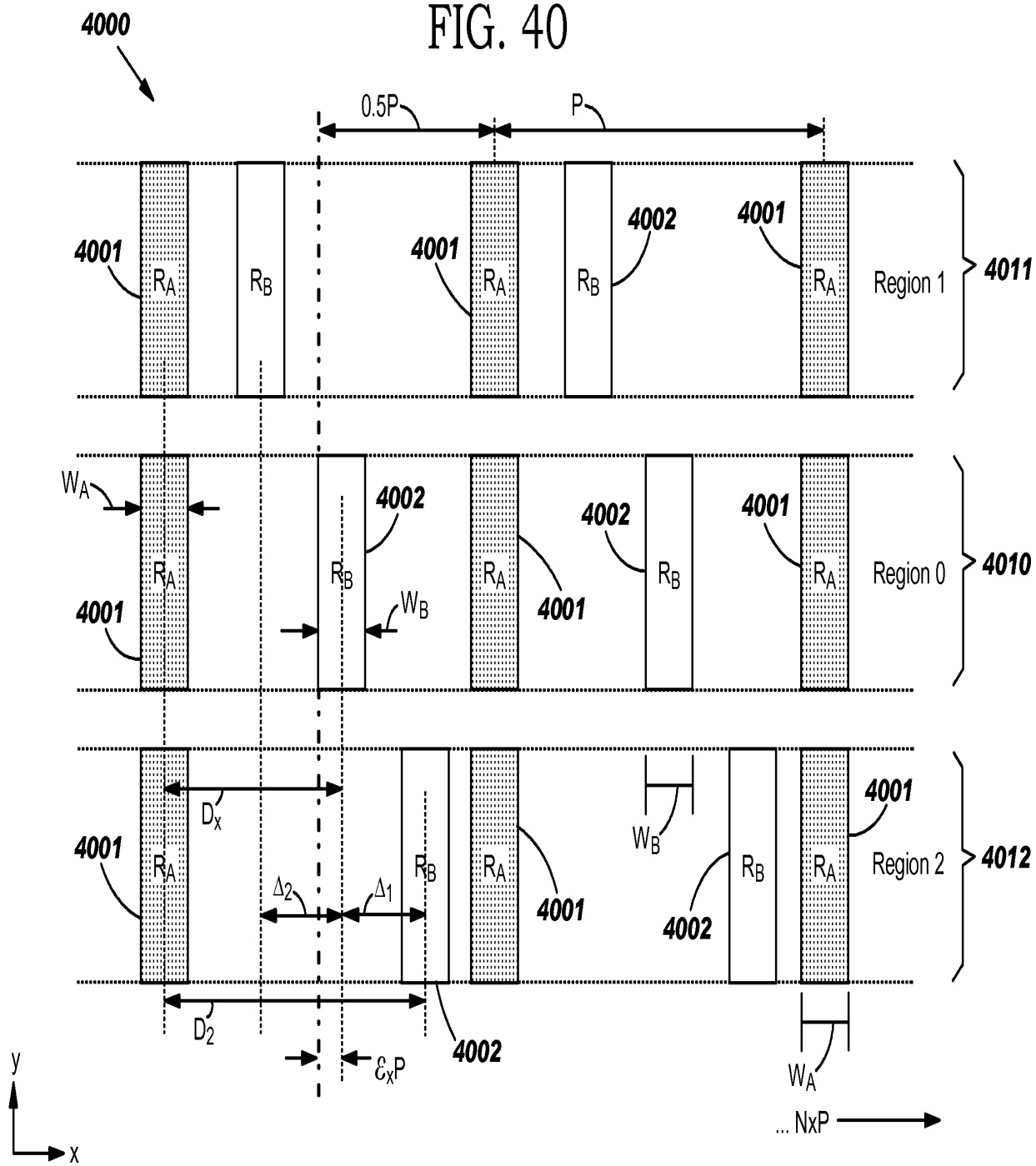
4000
0.5P
P
4001
R_A
R_B
4002
Region 1
4011
Region 0
4010
Region 2
4012
W_A
W_B
D_x
D_2
Δ_2
Δ_1
$\varepsilon_x P$
... NxP
y
x

FIG. 41A

FIG. 41B

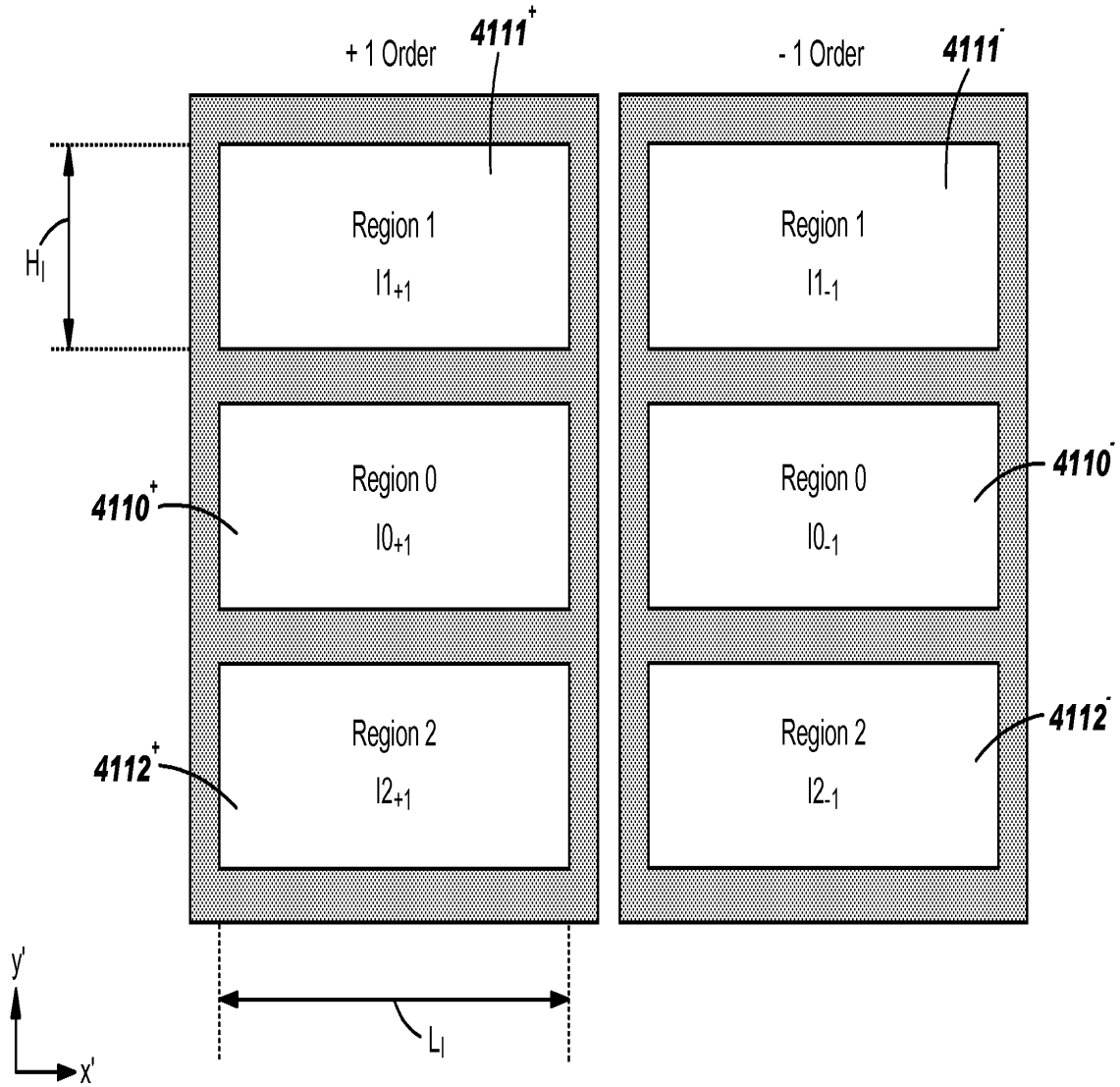

FIG. 42A

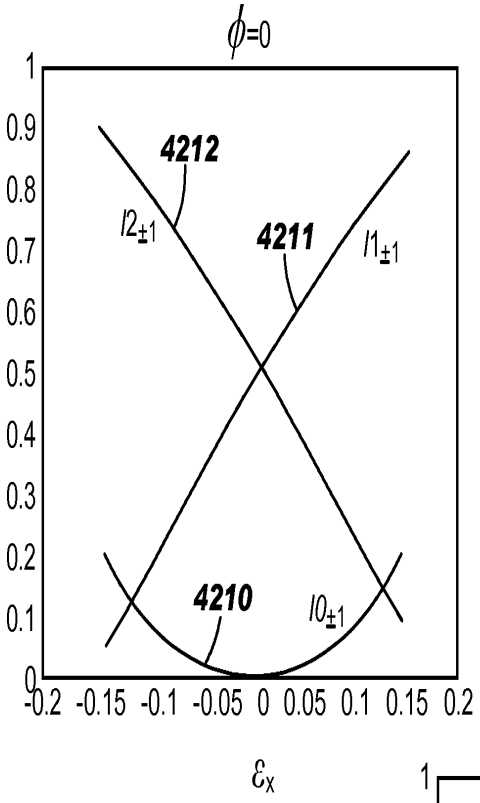

FIG. 42B

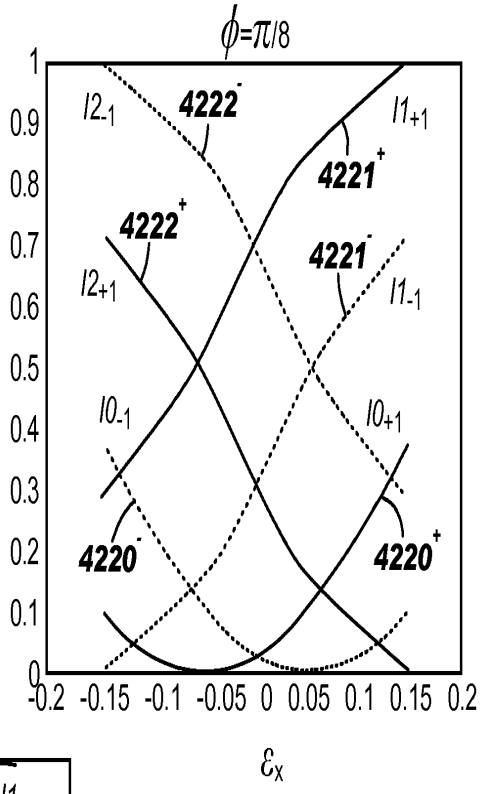

FIG. 42C

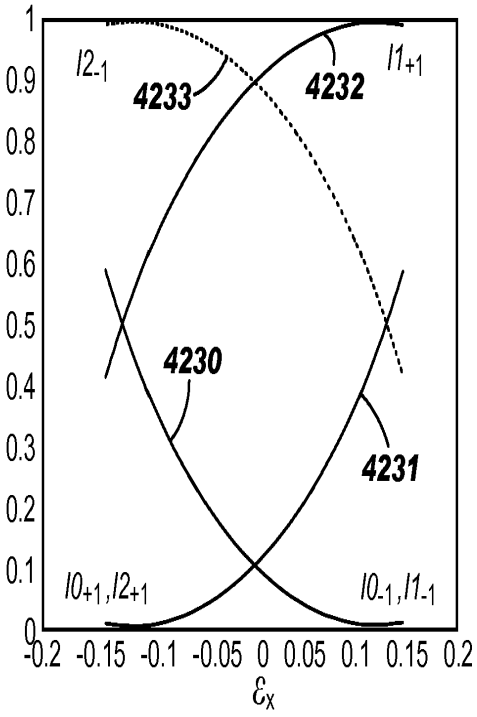

FIG. 43

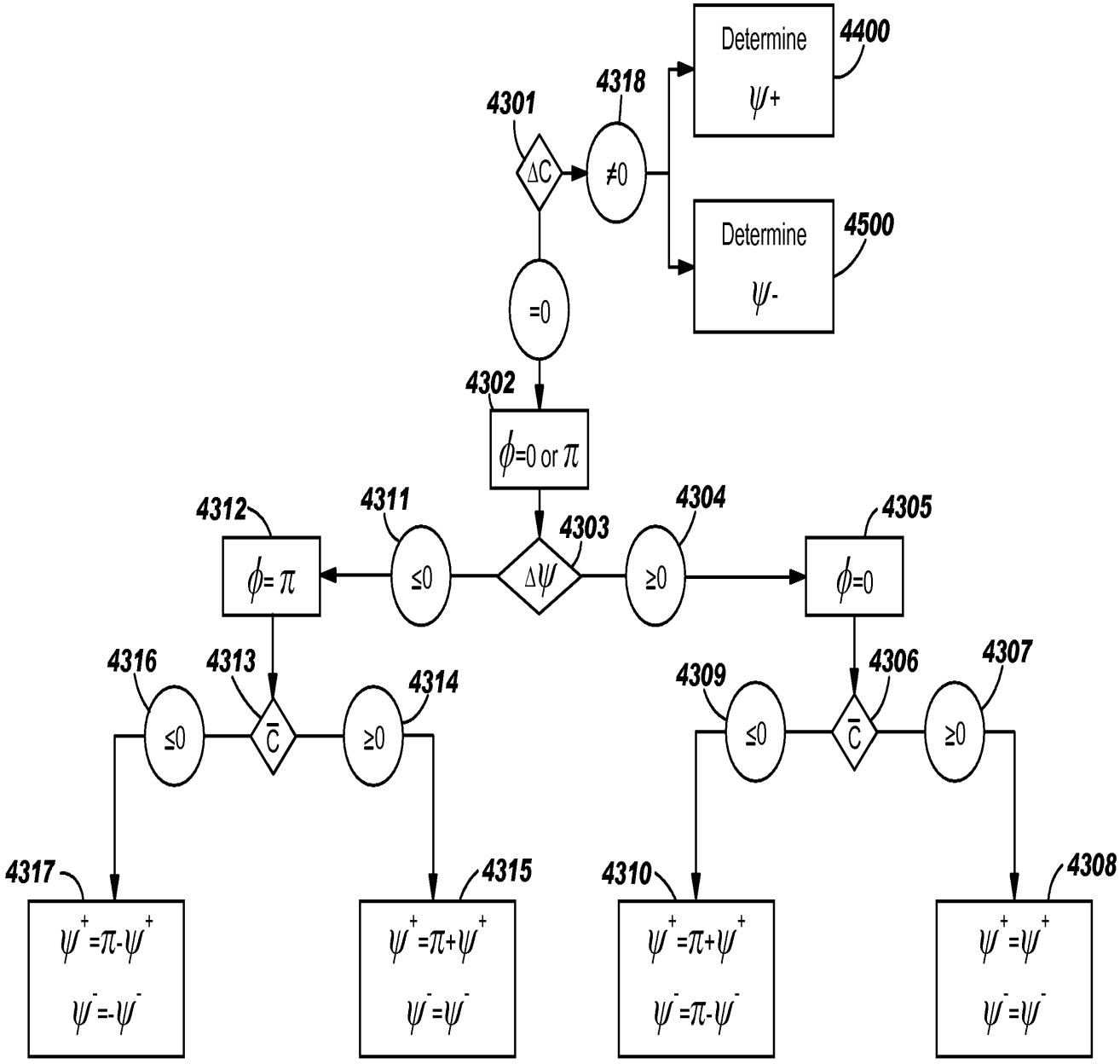
Determine
ψ+
4400
4318
4301
ΔC
≠0
Determine
ψ-
4500
=0
4302
ϕ=0 or π
4312
4311
4303
4304
4305
ϕ= π
≤0
Δψ
≥0
ϕ=0
4316
4313
4314
4309
4306
4307
≤0
C̄
≥0
≤0
C̄
≥0
4317
4315
4310
4308
ψ+=π-ψ+
ψ-=-ψ-
ψ+=π+ψ+
ψ-=ψ-
ψ+=π+ψ+
ψ-=π-ψ-
ψ+=ψ+
ψ-=ψ-

FIG. 44

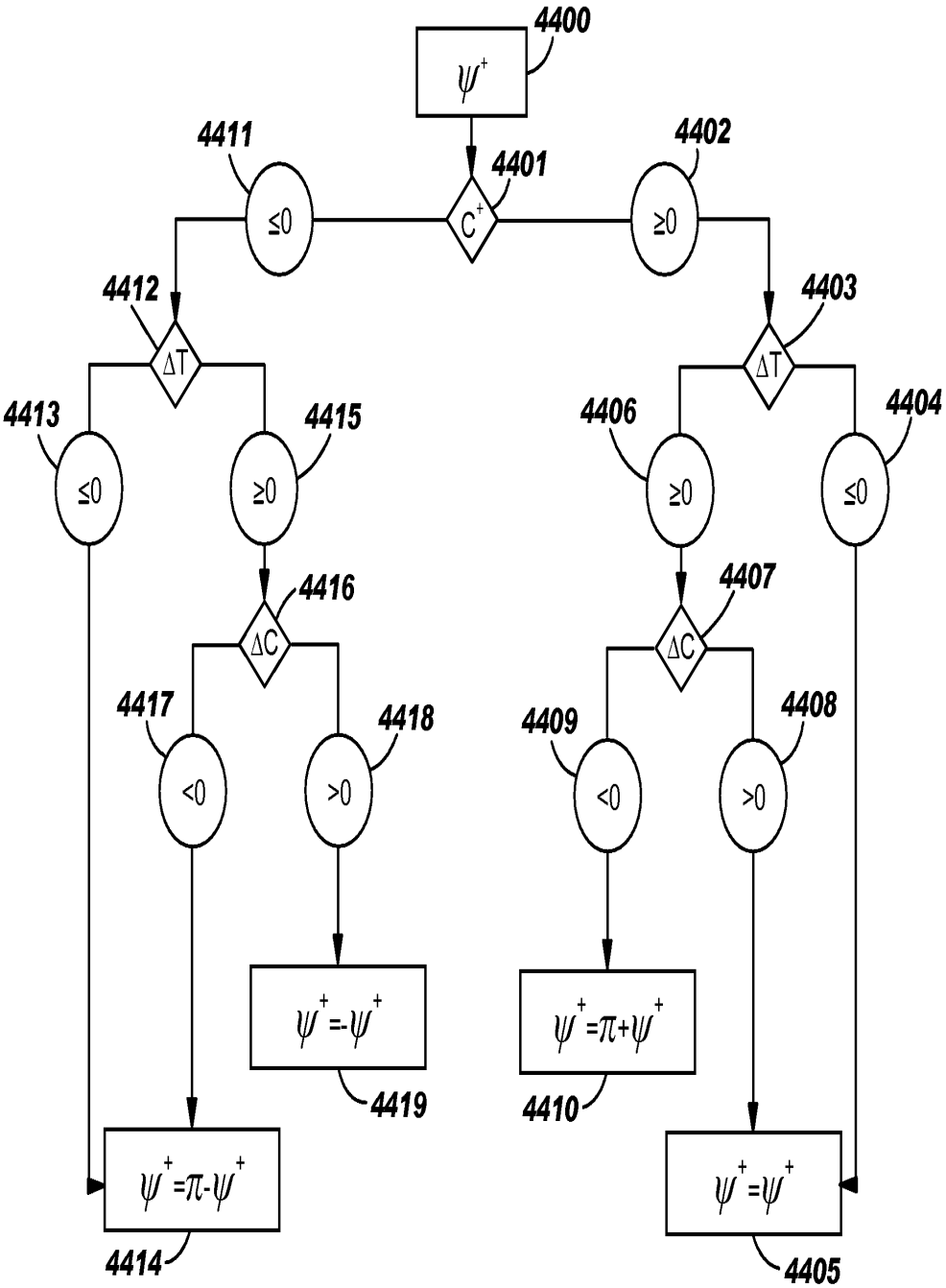
4400
ψ+
4411
4401
4402
≤0
C+
≥0
4412
4403
ΔT
ΔT
4413
4415
4406
4404
≤0
≥0
≥0
≤0
4416
4407
ΔC
ΔC
4417
4418
4409
4408
<0
>0
<0
>0
ψ+=-ψ+
ψ+=π+ψ+
4419
4410
ψ+=π-ψ+
ψ+=ψ+
4414
4405

FIG. 45

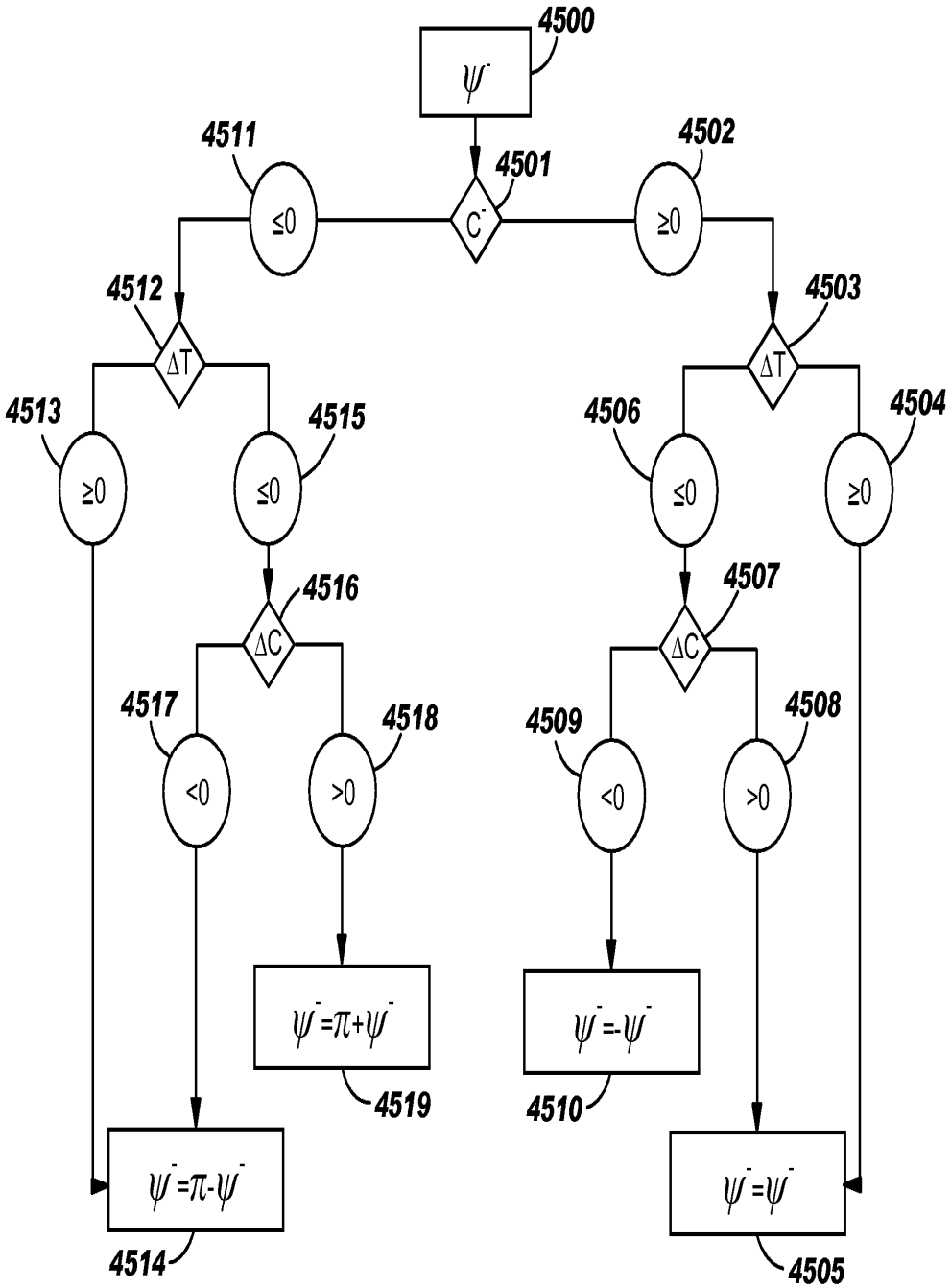
4500
ψ
4511
4501
4502
≤0
C
≥0
4512
4503
ΔT
ΔT
4513
4515
4506
4504
≥0
≤0
≤0
≥0
4516
4507
ΔC
ΔC
4517
4518
4509
4508
<0
>0
<0
>0
ψ=π+ψ
ψ=-ψ
4519
4510
ψ=π-ψ
ψ=ψ
4514
4505

FIG. 46A

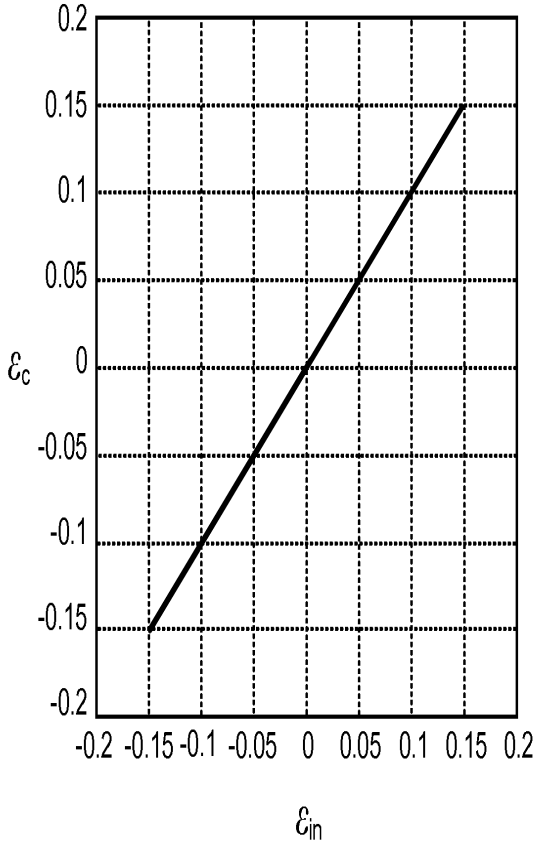

FIG. 46B

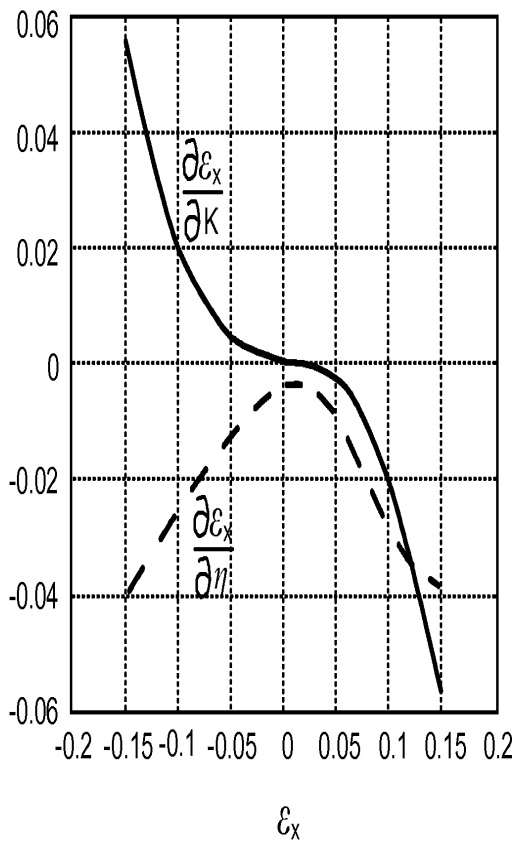

FIG. 47A

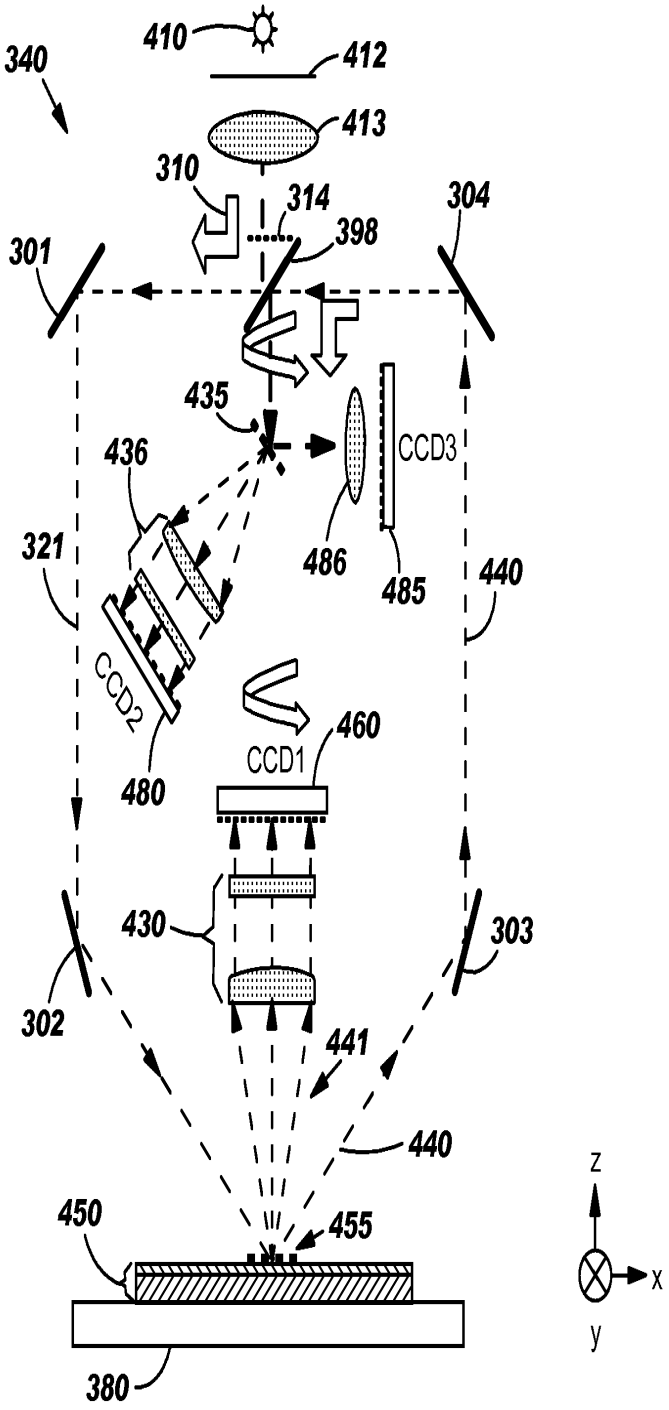

FIG. 47B

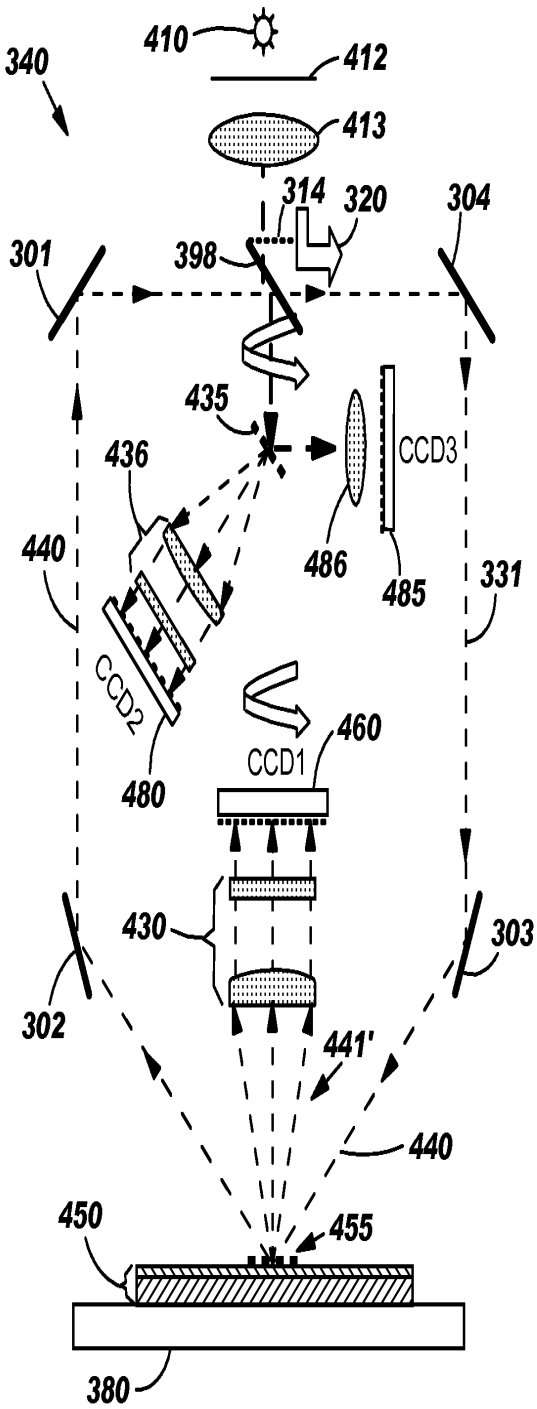

FIG. 48

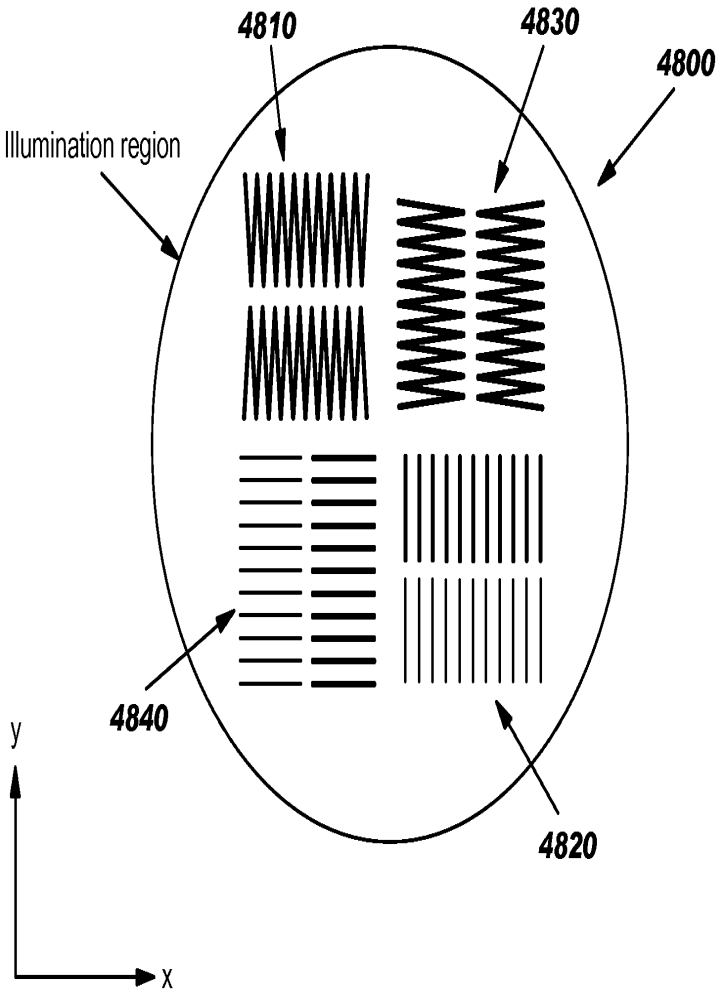

FIG. 49A

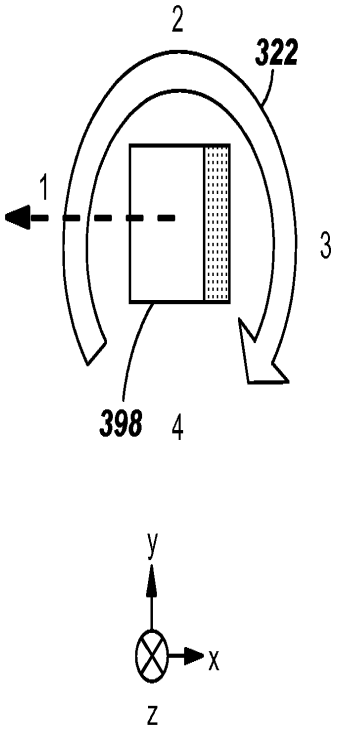

FIG. 49B

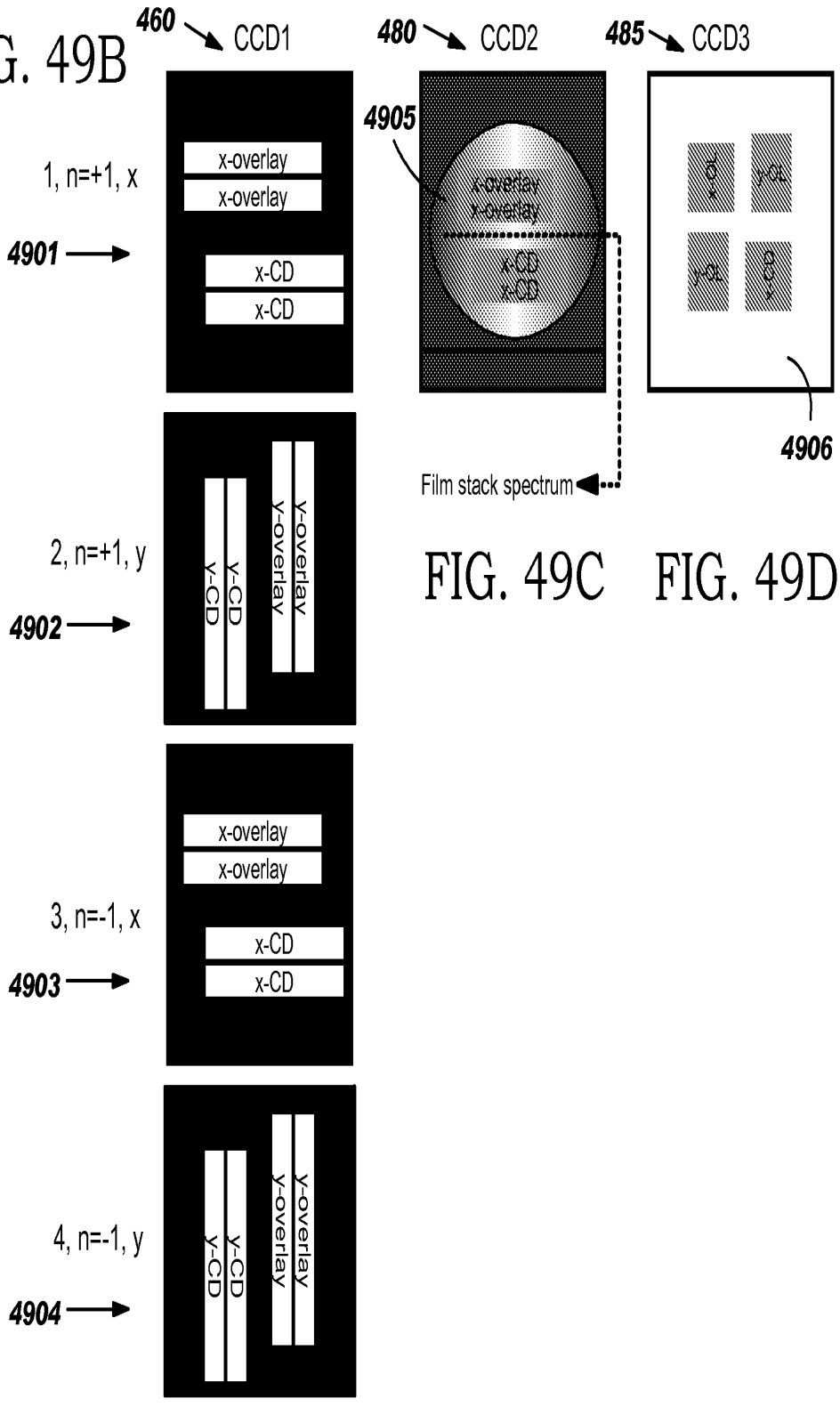

FIG. 49C

FIG. 49D

FIG. 50A

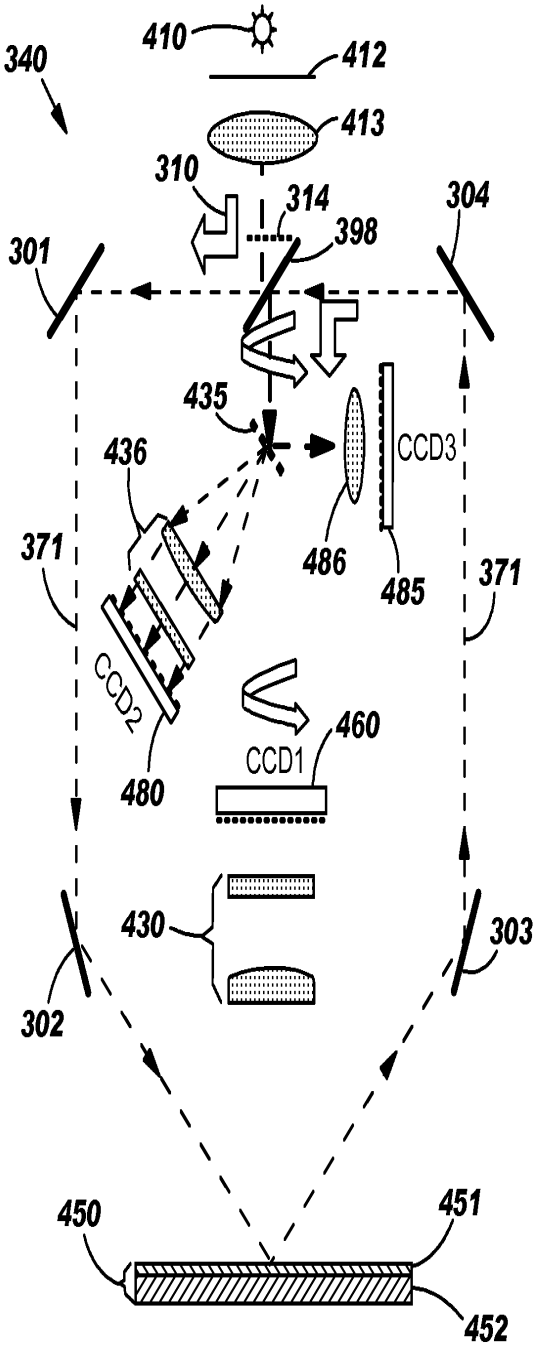

FIG. 50B FIG. 50C FIG. 50D

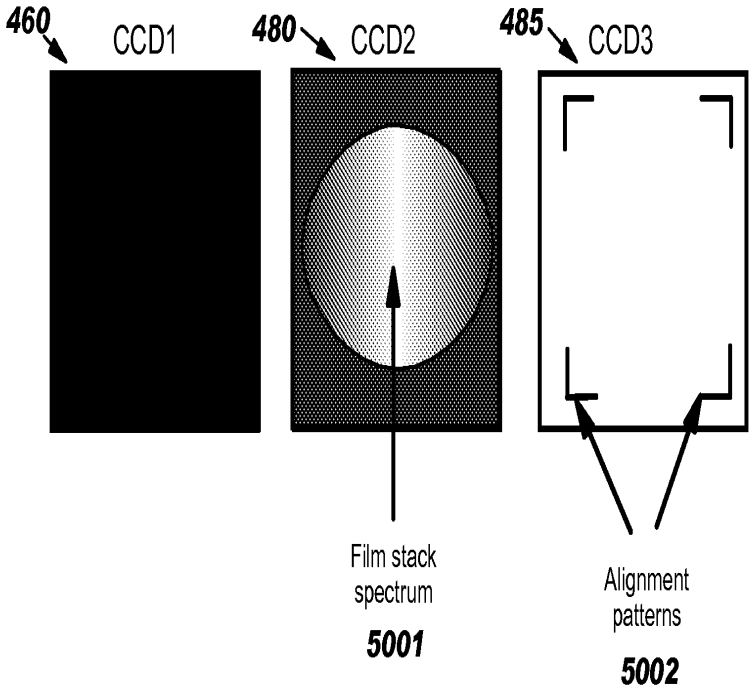

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FIG. 51

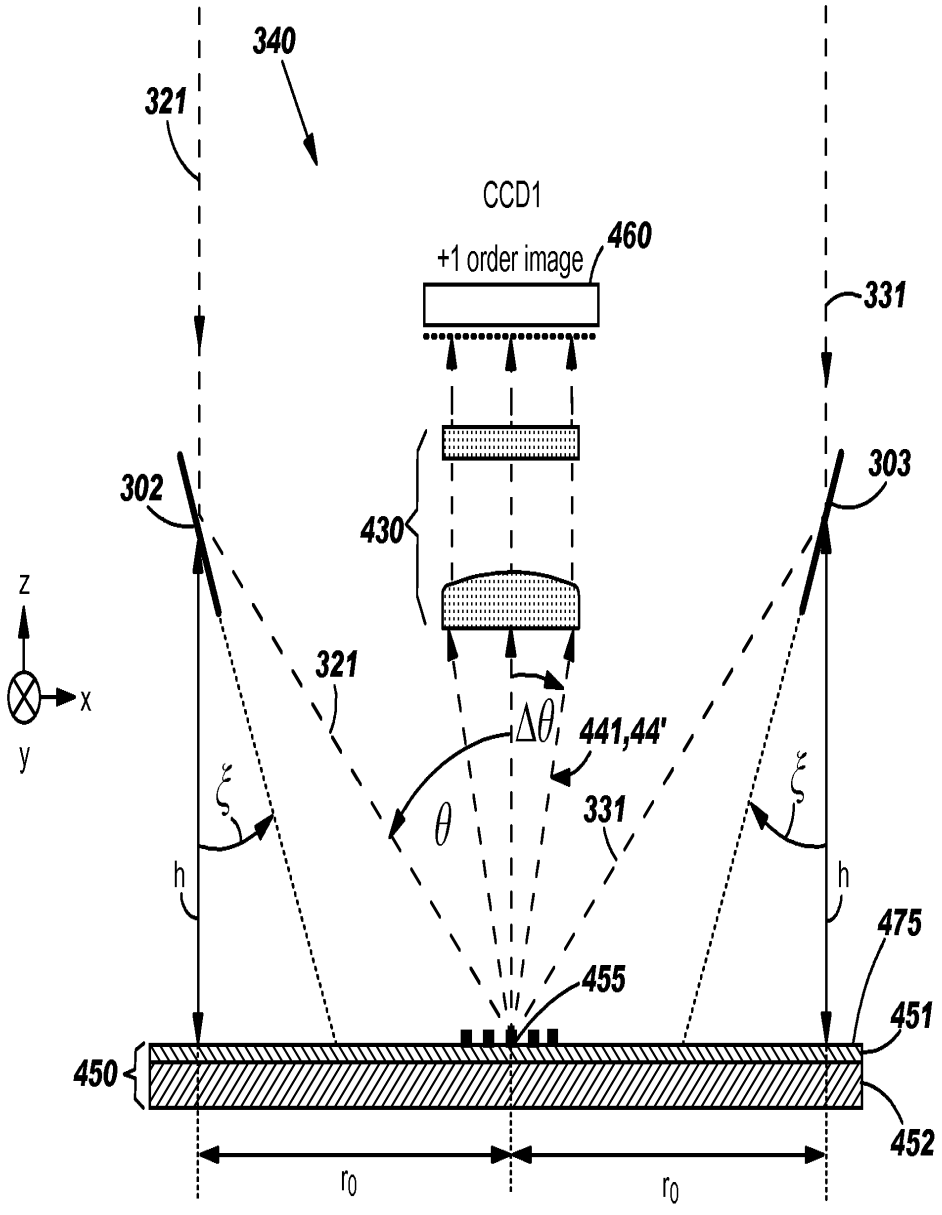

340
321
CCD1
+1 order image
460
331
303
302
430
z
x
y
321
$\Delta\theta_I$
441,44'
ξ
θ
331
ξ
h
h
475
455
451
450
452
r_0
r_0

FIG. 52

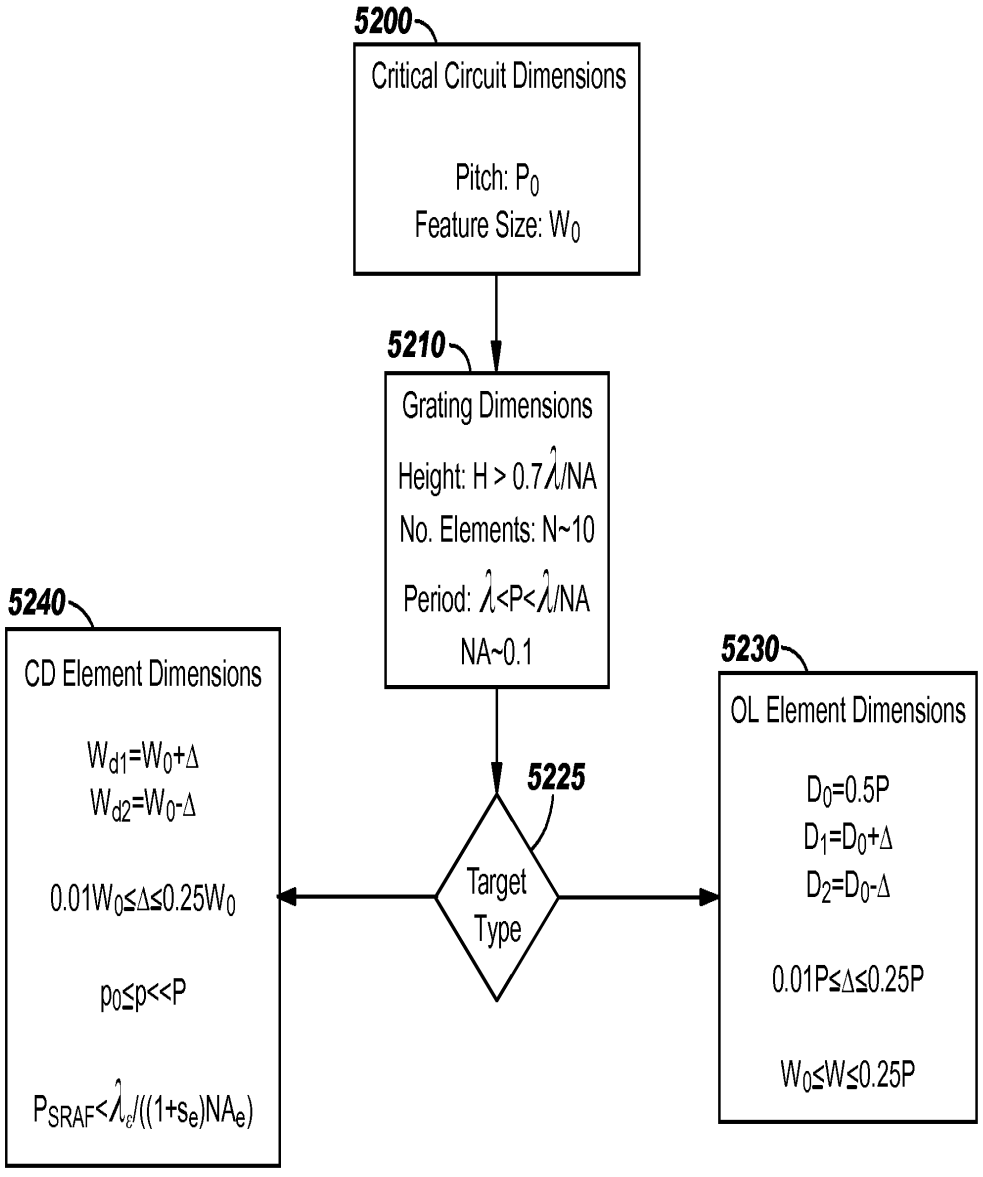

5200
Critical Circuit Dimensions
Pitch: P_0
Feature Size: W_0
5210
Grating Dimensions
Height: $H > 0.7\lambda/NA$
No. Elements: N~10
Period: $\lambda<P<\lambda/NA$
NA~0.1
5225
Target Type
5240
CD Element Dimensions
$W_{d1}=W_0+\Delta$
$W_{d2}=W_0-\Delta$
$0.01W_0\leq\Delta\leq0.25W_0$
$p_0\leq p<<P$
$P_{SRAF}<\lambda_e/((1+s_e)NA_e)$
5230
OL Element Dimensions
$D_0=0.5P$
$D_1=D_0+\Delta$
$D_2=D_0-\Delta$
$0.01P\leq\Delta\leq0.25P$
$W_0\leq W\leq0.25P$

FIG. 53

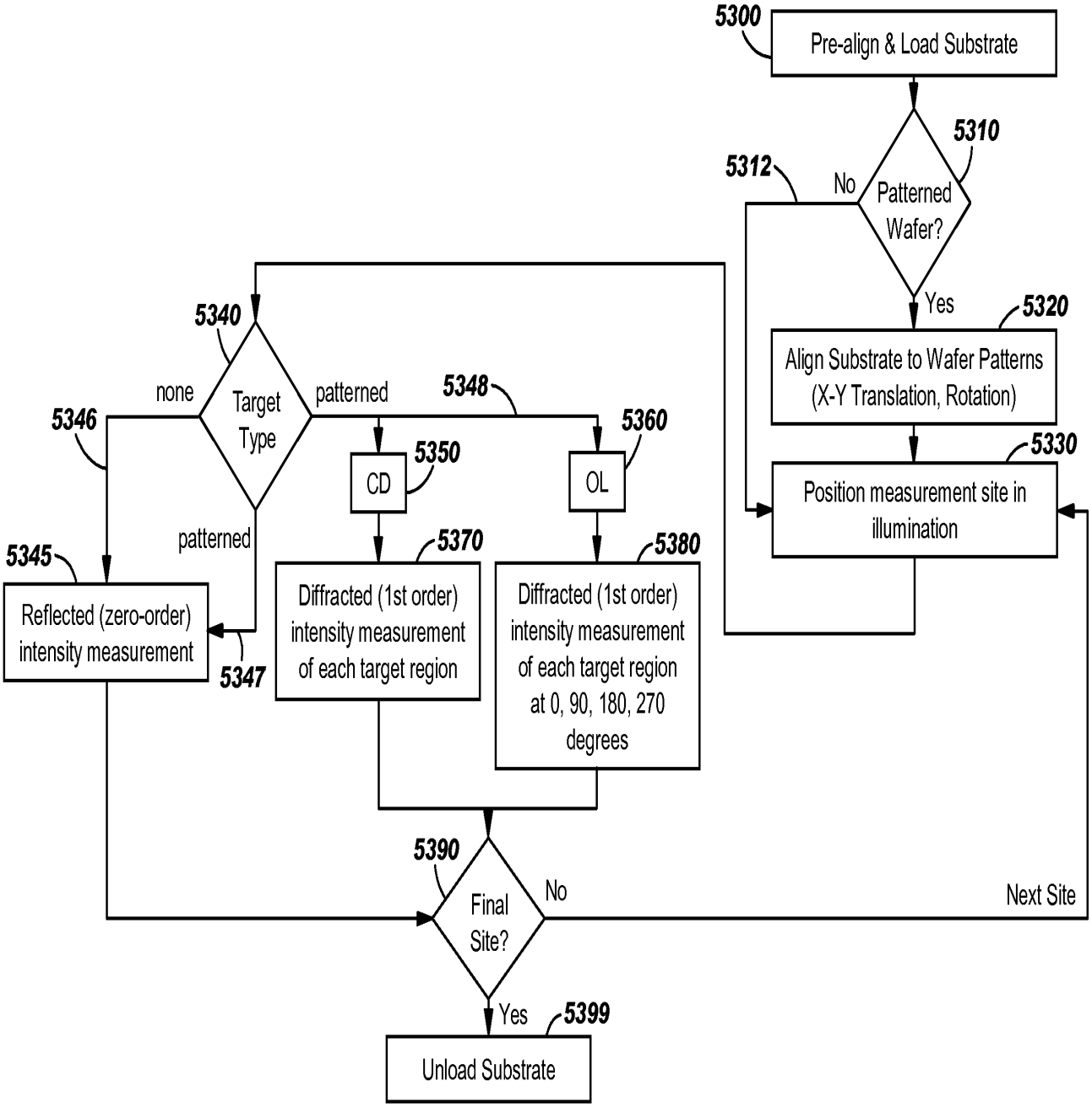


FIG. 54

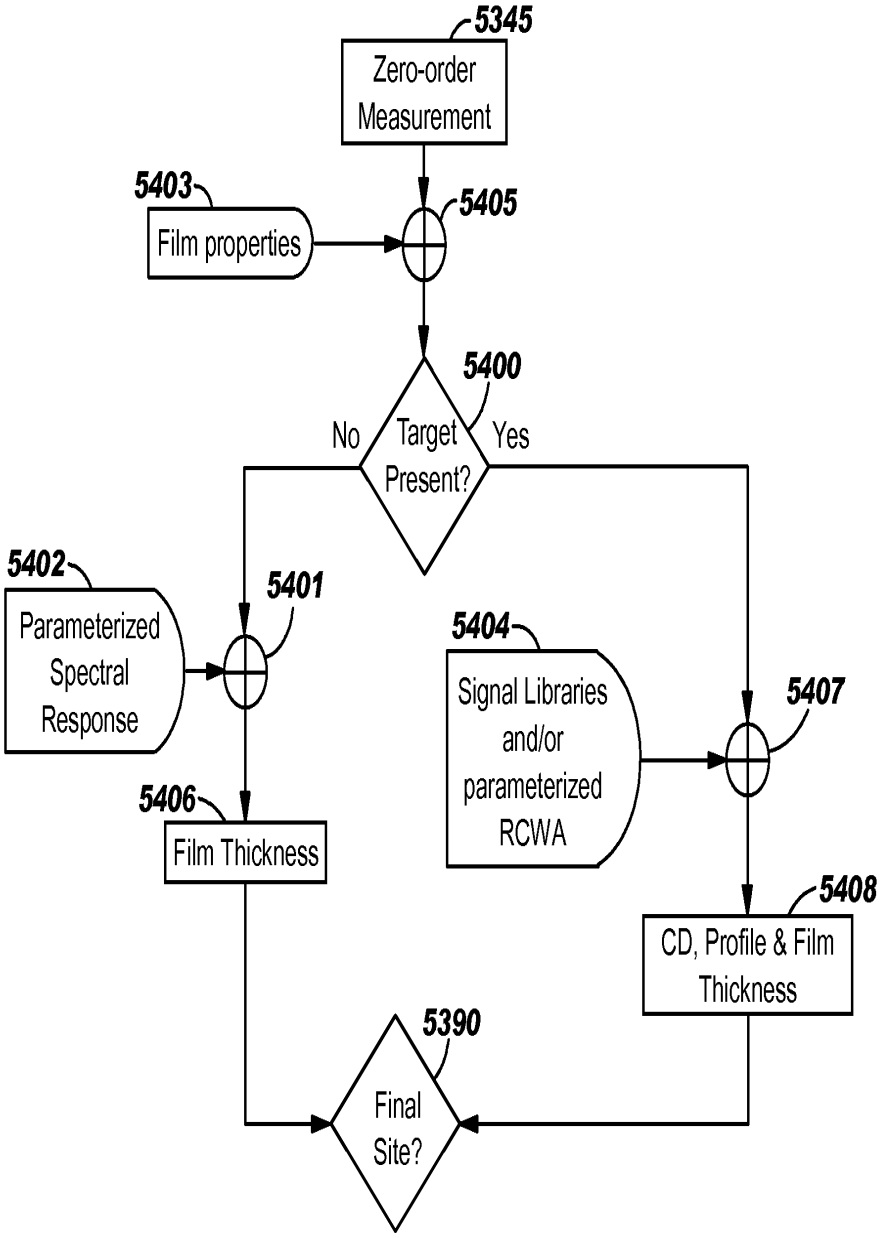
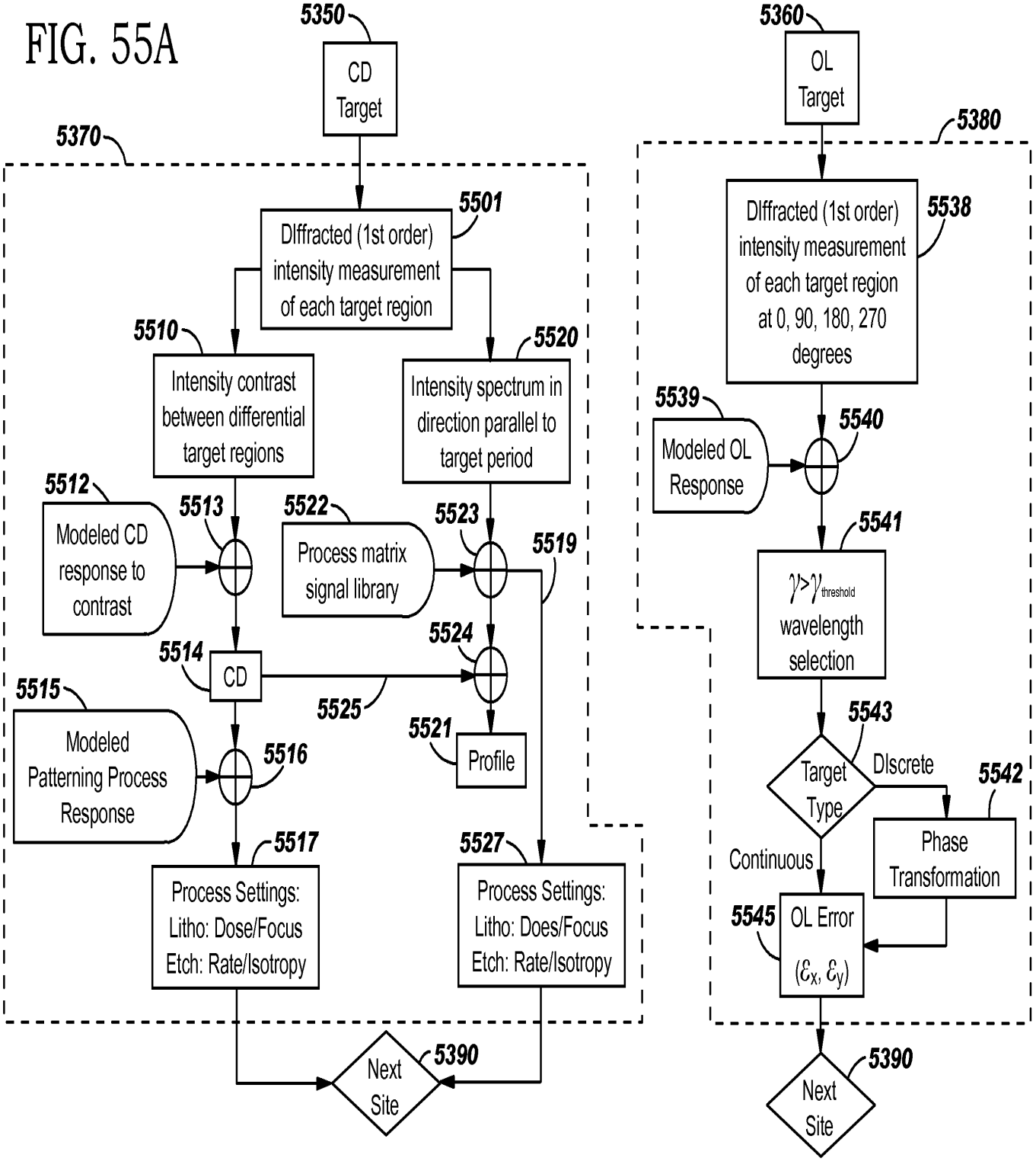

5345
Zero-order Measurement
5403
Film properties
5405
5400
No
Target Present?
Yes
5402
Parameterized Spectral Response
5401
5404
Signal Libraries and/or parameterized RCWA
5407
5406
Film Thickness
5408
CD, Profile & Film Thickness
5390
Final Site?

FIG. 55A



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